THE IMPACT OF TWO OFFICE ERGONOMICS INTERVENTIONS ON VISUAL SYMPTOMS

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Eye injuries and visual strain are expected to increase as the economy becomes dependent on a growing number of knowledge workers whose productivity relies on their computers. To date there is paltry evidence that demonstrates how best to design a workstation to reduce visual symptoms incidence. The objective of the current study was to examine the effect of an office ergonomics intervention program focused on improving health and productivity. Office workers at a department of revenue were invited to participate. The workers were assigned to three groups: a group that received a highly adjustable chair with office ergonomics training, a group that received only the office ergonomics training, and a control group that received the office ergonomics training only at the end of the study. Five periods of data collection occurred: two months and one month pre-intervention, and two months, six months, and 12 months post-intervention. For each of the data collection periods office workers completed web-based surveys focused on work environment and health. Multilevel modeling was conducted to test the hypotheses. Consistent with the findings in overall symptoms growth and productivity, visual symptoms growth were lowered in the chair-with-training intervention group after 12 months of follow-up (p=0.0001).

INTRODUCTION

The economy is leaning towards a knowledge workforce that relies almost entirely on computers. As upper extremity musculoskeletal disorders and symptoms become increasingly prevalent, symptoms of visual fatigue and eye strain are expected to grow as well. Few well-designed office ergonomics interventions have been able to demonstrate the effectiveness of interventions in reducing health symptoms and increasing productivity (Aaras et al, 1999, Aaras et al, 2001, Amick et al, 2003). There are no well-designed office ergonomics interventions that have been able to demonstrate improved visual health.

We have implemented a large-scale intervention to evaluate the impact of a highly adjustable chair and office ergonomics training on visual symptoms.

MATERIALS AND METHODS

Three groups were followed over 16 months of two pre-intervention data collection periods and three post-intervention data collection periods: one group that received the adjustable chair and office ergonomics training group (chair-with-training);

one group that received the office ergonomics training only (training-only); and a third group that served as a control group and received office ergonomics training only at the end of the study. Workers completed web-based surveys over the course of a five-day period. Those not completing at least 3 days of the five-day period were asked to complete a second week of web-based surveys. Data collection periods occurred at two months and one month pre-intervention and two months, six months, and twelve months post-intervention. The study protocol was approved by the Liberty Mutual Research Institute for Safety.

The intervention was designed around a theory of change hypothesized *a priori*. Figure 1 below illustrates this theory of change. The highly adjustable chair and office ergonomics training are expected to directly impact postures and behaviors as the chair will allow for adjustments in gaze height and distance. The training will directly impact knowledge by emphasizing the importance

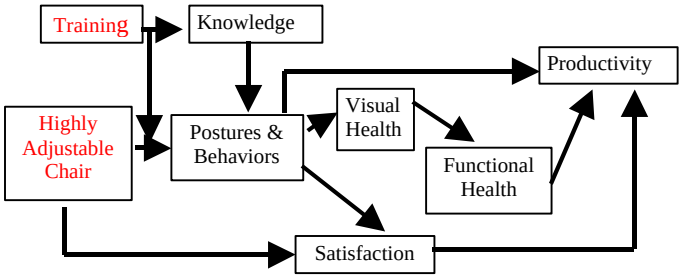

Figure 1. Theory of Change (modified from Amick et al, 2003)

of rest breaks and lighting. The change in knowledge and postures and behaviors will directly affect visual health.

It was hypothesized that the chair and training group would have improved visual health compared with the groups receiving training only and the control group. Furthermore, it was hypothesized that the training only group would have improved visual health compared to the control group. The hypothesis that the chair with training group would have greater improvement in visual symptoms compared to the training only group was also tested.

Participants were workers who had sedentary, computer-intensive jobs. They worked at least 4 hours per day at an office computer and at least 6 hours per day sitting in an office chair. Subjects who filed a workers' compensation claim within the past six months were excluded.

The outcome measure was a composite measure of eleven questions focused on the following visual symptoms: stinging, itching, feeling gritty, aching, light sensitivity, redness, tearing, dryness, burning, blurry vision, and difficulty focusing.

Confounders were chosen after a rigorous process. Covariates were considered for inclusion if they were associated with the outcome variable, were not greatly correlated with another selected variable, and were not evenly distributed between the study groups either pre-intervention or post-intervention. Finally, a stepwise backwards selection process was conducted and those covariates not significantly decreasing the model log likelihood were removed. The final multilevel model describing visual symptoms controlled for five confounding variables in addition to the main effects and their interactions (*MlwIN*, 2000). Residuals analysis did not result in any violations of assumptions necessary for model interpretation.

RESULTS

The following table lists the means for visual symptoms per group unadjusted for potential confounders. There is a clear trend where both the chair with training group and the training only group show a meaningful decrease in mean levels of visual symptoms compared with the control group. Furthermore, the mean visual symptoms levels

Table 1. Unadjusted visual symptoms means per group pre- and post-intervention.

Group	**Pre**	**Post**
Chair with training	2.06	1.22
Training	1.81	1.13
Control	2.70	2.65

decrease more with the chair with training group than the training only group.

Table 2 lists the visual symptoms means per group pre-intervention and post-intervention *adjusted* for five potential confounders: lighting, chair comfort, general (poor) health, use of eyeglasses, and time spent computing in chair. The differences in means pre- and post-intervention for the chair with training group has been attenuated somewhat, but it is clear there is a meaningful decline in symptoms before and after the intervention. There is no longer any difference for the training only group, and the control group has slightly worse symptoms after the intervention.

Table 2. Adjusted visual symptoms means per group pre- and post-intervention.

Group	**Pre**	**Post**
Chair with training	1.95	1.59
Training	1.53	1.54
Control	2.30	2.51

DISCUSSION

These results illustrate the importance of visual health in assessing the overall health effect of an office ergonomics intervention. The study design strengths (e.g. multiple pre-post intervention data collection with a control group) further enhance the relevance of the findings. Interventions such as these will play a role in providing businesses with the appropriate evidence-based research needed to make decisions about workstation design that will benefit the health of their workers. These findings of a chair with training group demonstrating improved visual health are consistent with those found by Amick et al (2003) and DeRango et al (2003) on overall health and productivity improvements.

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