

ABSTRACT

This poster reviews three studies related to the use of multifocal lenses and accidental falls. Most importantly, the implications of this research are discussed. Three implications for future research and design include: 1) training in the use of multifocal lenses; 2) awareness of negative outcomes; and 3) future design of multifocal lenses. New engineering developments could enable a leap forward in the prevention of injuries related to falling. Future design of multifocal lenses could include new optics for auto focus glasses or flip style designs.

BACKGROUND INFORMATION

Accidental falls are a large threat to the health of society. In the year 2000-2001, there were 542,000 falls resulting in visits to a hospital emergency room in people aged 45-64 in the United States [1]. In the year 2001-2002, unintentional falls were responsible for 4,134 deaths in the United States in people aged 45-64 [2]. One major study found multifocal glasses users were twice as likely to fall as nonmultifocal glasses wearers [3]. Joerger [4] investigated the use of multifocal glasses as a contributor to the risk of falling by causing impaired gait speed and quality. Multifocal lens design poses a visual problem. The bottom portions of the glasses are for near vision and blur or distort feet and walking surfaces. The current design of multifocal lenses is for convenience, and may pose problems if worn when walking.

Regular multifocal glasses wearers are twice as likely to fall as nonmultifocal wearers.

PURPOSE

The purpose of this investigation is to access the possible dissistive nature of multi-focal lenses, and to discuss possible implications for assistive technology providers and rehabilitation specialists.

LITERATURE REVIEW

Several studies pose that the use and design of bifocal lenses may actually cause falling. These are reviewed and discussed as to their implications of interest to the assistive technology field.

Lord et al. [3] examined 156 community dwelling people aged 63-90, of which 87 were regular wearers of multifocal lenses, meaning they wore them for all activities of daily living (ADL), including walking outside of the home. Of these subjects, 148 were available for follow-up. Regular multifocal glasses wearers were at an increased risk of falls. The results are highlighted below in Table 1.

Falls	Wearers		Relative Risk (95% CI)
	n (%)	Nonwearers	
≥1 fall	40 (48.2)	24 (36.9)	1.31 (0.89-1.92)
Fall causes			
Tripping	24 (28.9)	9 (13.8)	2.09 (1.04-4.18)
Tripping outside	21 (25.3)	7 (10.8)	2.35 (1.06-5.18)
Other*	22 (26.5)	13 (20.0)	1.33 (0.72-2.42)
Fall locations			
Outside the home	33 (39.8)	16 (24.6)	1.62 (0.98-2.67)
Stairs	12 (14.5)	0 (0.0)	Not calculable
Path, curb, or road	17 (20.5)	11 (16.9)	1.21 (0.61-2.40)
Inside the home	15 (18.1)	8 (12.3)	1.47 (0.66-3.25)

* Slipping, loss of balance, legs giving way, dizziness

Regular multifocal glasses wearers are significantly more likely to fall because of a trip, a trip outside the home, or when walking up or down stairs.

This study indicates that blurring the lower visual field impairs depth perception and edge contrast sensitivity at critical distances for detecting objects in the environment when walking. Therefore, multifocal glasses appear to increase the risk of a tripping fall by reducing the capacity of older adults to perceive obstacles in the environment. To further validate these findings, the subject's in this study who chose not to wear their multifocal glasses when walking outside, did not have an elevated risk of falls.

LITERATURE REVIEW Contd.

Joerger [4] investigated gait speed, using the Get-Up-and-Go Test (GUGT), and quality, using the Timed-Get-Up-and-Go Test (TGUGT) under the conditions of wearing bifocals and not wearing bifocals in 30 healthy college students. The total mean average score on the GUGT was 1.29 while not using bifocals, with an increase of 0.34 with the use of bifocals. This findings revealed a statistically significant difference with a t value of -5.20 with $p \leq .000$, as seen in Table 2. These findings suggest that the use of bifocal glasses affect the quality of gait.

Paired Sample t-test	Paired Differences				
	Mean	SD	t	df	p
GUGT without bifocals	1.29	.303	--	--	--
GUGT with bifocals	1.63	.439	--	--	--
GUGT with & without bifocals	-.339	.357	-5.20	29	.000

A third study, focusing on the behavioral factors contributing to falls [5] found eyesight behaviors to be a behavioral theme contributing to falls. Eyesight behaviors is defined as "the manner in which they compensate for, misjudge, or fail to notice details in their environment due to problems with their eyesight (p. 110)." This can include the use or nonuse of multifocal glasses. One subject in the study believes that problems with her multifocal glasses contributed to her misjudging the height of the drain on which she caught her foot and then tripped. She now tends to walk without her glasses because she feels that they restrict her vision in many ways.

Ophthalmologists and optometrists often anecdotally report that if a patients seems tenuous in their balance of gait, they recommend single lens glasses and switching them when reading. While not a standard, this clinical experience further supports a need for developing interventions around multifocal lens use.

LITERATURE ANALYSIS

Based on the limited research on the use of multifocal glasses and falling, it appears that a potential enormous health problem may be resulting from a very common technology used as an assistive device. While a large amount of research has been reported on visual impairments and risk of falling, the link between eyeglasses and falling has only begun to be addressed. The current lack of empirical evidence, however, does not need to keep professionals from beginning to develop and design alternatives to the current usage of multifocal lenses.

IMPLICATIONS

There are three main implications for assistive technology providers and rehabilitation specialists.

1) Patients need to be trained in the proper use of multifocal lenses

For example, multifocal lenses can be purchased at a drug store without any accompanying information on use or possible risks. Multifocal lenses were designed for the purpose of convenience, and are not intended to be worn when walking, yet many consumers of multifocal lenses are not provided with this information.

2) More research needs to be performed in the field of negative outcomes of AT

Not only do we need to be aware of the possible negative aspects of AT, we also need to understand those negative aspects. If assistive technology truly results in harm, injury or decreased performance, we need to be aware of this and be creating preventative solutions.

3) New, safer designs of multifocal lenses should be considered

This problem has implications in the future design of multifocal lenses. To make multifocal lenses safer for users, new designs should be considered. This includes new optics for auto focus glasses, flip style designs, or glasses that signal when someone stands or walks with them.

REFERENCES

1. National Center for Health Statistics, *Health, United States, 2004, with chartbook on trends in the health of Americans*. 2004, Hyattsville, MD.
2. National Center for Injury Prevention and Control, *2001-2002, United States unintentional fall deaths and rates per 100,000*, Centers for Disease Control and Prevention.
3. Lord, S.R., Dayhew, J. & Howland, A. (2002) Multifocal glasses impair edge-contrast sensitivity and depth perception and increase the risk of falls in older people. *Journal of the American Geriatrics Society*, 50(11), 1760-1766.
4. Joerger, T.F. (2003). *Risk of falling: The relationship between assistive technology use and the quality and speed of gait*, Unpublished master's thesis, University of Wisconsin-Milwaukee.
5. Clemson, L., Manor, D., & Fitzgerald, M.H. (2003). Behavioral factors contributing to older adults falling in public places. *Occupational Therapy Journal of Research: Occupation, Participation and Health*, 23(3), 107-117.

ADDITIONAL INFORMATION

The paper for this poster can be found in the [Proceedings of the RESNA 2005 Annual Conference](#).

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