Use of Single-Vision Distance Spectacles Improves Landing Control during Step Descent in Well-Adapted Multifocal Lens-Wearers

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Purpose. Epidemiologic research has shown that multifocal spectacle wearers (bifocal and progressive addition lenses [PALs]) are more than twice as likely to fall than are nonmultifocal spectacle wearers, with this risk further increasing when negotiating stairs. The present study investigated whether step and stair descent safety is improved by using single-vision distance lenses.

Methods. From a stationary standing position on top of a block, 20 long-term multifocal wearers stepped down (from different block heights) onto a lower level wearing bifocal, progressive addition, or single-vision distance lenses.

Results. Use of single-vision distance spectacles led to an increased single-limb support time, a reduced ankle and knee angle and vertical center-of-mass velocity at contact with the lower level, and a reduced ankle angular velocity and vertical center-of-mass velocity during initial landing ($P < 0.03$). These findings indicate that landing occurred in a more controlled manner when the subjects wore single-vision distance spectacles, rather than tending to "drop" onto the lower level as occurred when wearing bifocals or PALs.

Conclusions. Use of single-vision distance spectacles led to improvements in landing control, consistent with individuals' being more certain regarding the precise height of the lower floor level. This enhanced control was attributed to having a view of the foot, step edge, and immediate floor area that was not blurred, magnified, or doubled and that did not suffer from image jump or peripheral distortions. These findings provide further evidence that use of single-vision distance lenses in everyday locomotion may be advantageous for elderly multifocal wearers who have a high risk of falling. (*Invest Ophthalmol Vis Sci.* 2010;51:3903–3908) DOI:10.1167/iovs.09-4987

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Supported by a studentship (MAT) furnished as part of a grant from The Health Foundation (3991/3322, grant awarded to JGB); a Nursing and AHP (Allied Health Professions) Researcher Development Award from the Department of Health and the National Health Service NHS (LJ); and an Research Councils UK (RCUK) Academic Fellowship (JGB).

Submitted for publication November 27, 2009; revised January 25, 2010; accepted February 20, 2010.

Disclosure: **M.A. Timmis**, None; **L. Johnson**, None; **D.B. Elliott**, None; **J.G. Buckley**, None

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Epidemiologic research has shown that multifocal spectacle wearers (bifocal and progressive addition lenses [PALs]) are more than twice as likely to fall than are nonmultifocal spectacle wearers,[1] with this risk further increasing when negotiating stairs.[1,2] Negotiating steps, stairs, and surface height changes may be particularly problematic for multifocal spectacle wearers because they are likely to view the step or stair edge through the lower region of the lens designed for reading, which is typically focused at approximately 40 cm (16 in.) (Fig. 1). The lower visual field, including the view of any surface height change and the foot, are therefore blurred, and thus the exact and relative height of the floor is difficult to judge.[1] The additional dioptric power in the reading section of the lenses will also magnify objects such that step and stair edges will appear higher and closer than they actually are. Such effects, when presented acutely, have been shown to significantly affect an individual's gait when walking onto a raised surface.[3] Multifocal wearers are likely to adapt to the blur/magnification effects with time. Even so, long-term multifocal wearers still display increased variability in foot positioning when walking up to[4] and increased toe clearance variability when stepping onto[5] a raised surface, and they make more accidental contacts with it[4–6] than when wearing single-vision distance spectacles. Multifocals have been shown to have no effect on standing postural stability.[7]

In older adults, falls occur about three times as often during stair descent as during stair ascent,[8,9] and falls on stairs are a leading cause of accidental death, multiple injuries, and hospitalization in older people.[8,9] In addition, vision is believed to play a major role in the successful negotiation of stairs,[8] yet surprisingly, given the high percentage of elderly individuals who wear multifocal spectacles,[1] no previous studies have reported whether their use causes difficulties when descending steps or stairs. Previous work indicates that estimating the precise height of the lower surface, and/or the foot's position relative to it, is dependent on visual information gained before movement initiation.[10–12] If the lower visual field is occluded, individuals adapt their landing behavior by moving the landing limb into place earlier during the descent and reducing vertical impact forces during the initial contact period, but make no alteration in stepping strategy.[12] These changes are likely to be due to a lack of exproprioceptive visual information (foot position relative to the environment) so that individuals were unable to modulate landing in the same way as occurred when they had access to full-field vision.[12] When the individual descends steps and stairs wearing multifocal lenses, the lower floor area and foot becomes blurred and magnified when viewed through the lower portion of the lens. This distortion results in uncertainty in determining the precise instant of foot contact, which we hypothesized would lead to reduced landing control and/or increased landing control variability, either of which could affect safety.

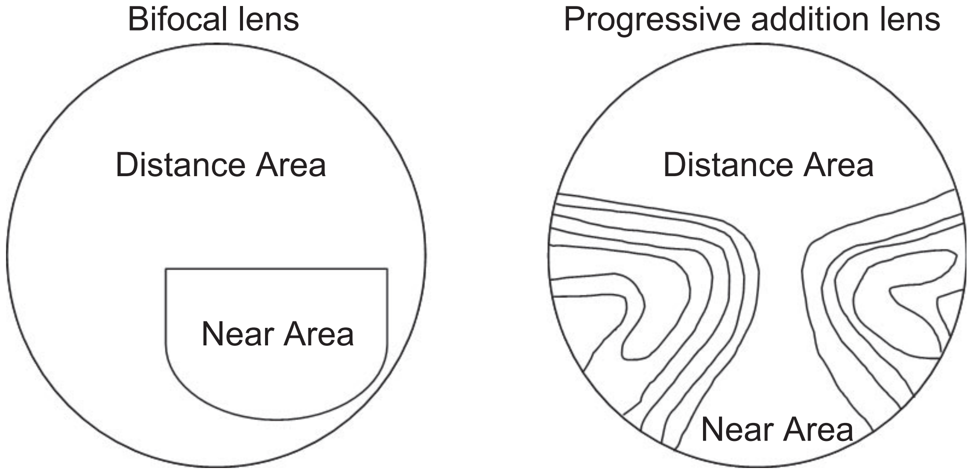

FIGURE 1. Areas of bifocal and PALs that provide clear vision for distant and near objects. The PAL also includes a corridor of clear vision for objects at intermediate distances and the peripheral areas of distortion.

Therefore, the focus of the present study was to determine whether step and stair descent control in older long-term multifocal wearers is improved when they wear single-vision distance lenses. Specifically, the goal was to determine in habitual multifocal lens wearers stepping down from various heights whether landing becomes less variable and/or more controlled when wearing single-vision distance spectacles than when wearing multifocals.

METHODS

Subjects

Twenty community-dwelling subjects (12 women and 8 men; mean age, 71.9 ± 4.2 years; range 62–80; height, 1.65 ± 0.08 m; BMI, 26.2 ± 3.5 kg/m^2) were recruited according to published inclusion and exclusion criteria.[5] All subjects were independently mobile; were able to follow simple instructions; and, according to self-report, had no neurologic, musculoskeletal, or cardiovascular disorders that could interfere with balance control or stepping. Those with vestibular disturbances, diabetes, a history of falling in the previous year, or taking medications that could affect balance or vision were excluded. Physical activity levels were determined by self-report using the activity scale of the Allied Dunbar National Fitness Survey.[13] All subjects engaged in light to moderate physical activities including, for example, gardening, light house work, and dancing for at least 30 minutes, 5 days a week. The subjects had normal healthy eyes, determined by a full eye examination including ocular screening using slit lamp biomicroscopy, tonometry, indirect ophthalmoscopy, central visual field screening, and binocular vision assessment. The subjects had habitually worn multifocal spectacles for at least 3 years (median 13 years, range 3–30 years). Nine wore PAL and 11 wore bifocals, and this included a variety of different types of bifocal and PAL spectacles. Seven subjects were myopes and 13 were hyperopes. Median distance spectacle spherical equivalent power was +2.00 DS (range, −4.75 to +5.75), and the median reading addition required was +2.25 DS (range, +1.75 to +2.75). The tenets of the Declaration of Helsinki were observed and the experiment gained approval from the local Research Bioethics Committee. All subjects gave written informed consent and were asked to refrain from alcohol intake during the evening before testing.

Each subject had three pairs of spectacles made for them: bifocals, PALs, and single-vision distance, using the refractive error determined from their own spectacles by focimetry. Each subject was provided with slightly different frames and sizes to ensure optimal fit, but the three pairs of spectacles used by each subject were identical in frame style and size and were fitted to ensure the same back vertex distance and pantoscopic angle. The bifocal type was a 28-mm diameter D-segment and the PALs were Norville NCF5 (The Norville Group Ltd., Gloucester, UK), a commonly used PAL in the United Kingdom that is a compromise hard–soft design. All PALs were positioned with the fitting cross-alignment at the center of the pupil in primary gaze, and the top of the bifocal segment was aligned with the patient's lower lid.

Clinical Evaluation

We assessed how vision was affected by the different portions of the multifocal lenses by measuring binocular visual function with (1) near, (2) intermediate (calculated at 50% of the reading addition power), and (3) distance refractive corrections, using full-aperture trial frames. Contrast sensitivity was measured by Pelli-Robson chart[14] with a letter-by-letter scoring system and a chart luminance of 200 cd/m^2 (Ref. 15); visual acuity (VA) was measured with high (90%)- and low (25%)-contrast Regan logMAR charts,[16] with a letter-by-letter scoring system and chart luminance of 160 cd/m^2 (Ref. 17); and depth perception was determined with the Howard-Dohlman apparatus (mean of three trial results). To determine visual function at a distance that would be encountered when negotiating steps and curbs in the real world,[18] we performed visual assessments at a distance that was equivalent to that (average, 1.4 m) between each subject's eye and the floor level when standing on a 15-cm-high block. LogMAR and depth perception (stereoacuity) scores were then derived by incorporating a correction factor for each subject's working distance. Contrast sensitivity, visual acuity, and depth perception scores for the three refractive prescrip-

TABLE 1. Visual Function (at 1.4 m) Test Results for the Three Refractive Prescriptions

Test	Distance	Intermediate	Near
High-contrast visual acuity, log MAR	−0.08 (0.05)	−0.02 (0.13)	0.34 (0.19)^{D,I}
Low-contrast visual acuity, log MAR	0.01 (0.07)	0.10 (0.16)	0.54 (0.15)^{D,I}
Contrast sensitivity, log	1.90 (0.07)	1.87 (0.10)	1.73 (0.17)^{D,I}
Depth perception, min arc	11.8 (7.8)	20.0 (14.2)	42.2 (25.9)^{D,I}

Data are expressed as the mean (±SD).
Significant difference between distance and near (^{D}) and intermediate and near (^{I}) ($P < 0.001$).

tions are presented in Table 1. These scores indicate that vision was significantly worse when viewing with the near than with either the distance or intermediate prescription.

As plantar cutaneous sensation plays an important role in postural control,[19,20] the sensitivity of the soles of the subjects' feet was assessed by determining the ability to detect a 10-g force applied to five key sites (hallux; first, third, and fifth metatarsal heads; and heel) using a monofilament (Bailey Instruments, Ltd., Manchester, UK).[21] Sixteen subjects had normal sensation, and four had reduced sensation at one or two sites tested on the forefoot. The inability to detect monofilament appeared to be due to callus formation. In all cases, when the skin was tested immediately adjacent to the callused area, sensation was present. Functional mobility was assessed with the timed up-and-go (TUG) test.[22] The subjects took a mean of 8.2 ± 1.2 seconds to complete the test, which classified them as functionally independent and nonfallers.[23]

Step Descent Protocol

From a stationary standing position on top of a block that was placed over a force platform, the subjects stepped down onto an adjacent force platform. The force platforms (AMTI OR6–7; Advanced Mechanical Technologies Inc., Boston, MA) measured (at 100 Hz) the contact forces between the foot and the ground. A five-camera, three-dimensional, motion-analysis system (Vicon 250; Oxford Metric Ltd., Oxford, UK) was used to simultaneously record (at 50 Hz) body segment kinematics as participants completed each step down. Three block heights were used, equating to those of a curb (7.5 cm), a stair riser (15.0 cm), and stepping from a bus (22.0 cm)—obstacles frequently encountered in daily life.[24] Blocks were constructed from medium-density fiberboard of 1.8-cm thickness, which were bonded together to create a solid block with standing area 46.4 × 50.8 cm. Each block was covered with colored vinyl material that matched the surrounding floor. Room illuminance, measured at head height, was approximately 300 lux, and the luminance of the floor and top surface of the step was 30 cd/m^2 measured with a photometer (CS-100; Minolta Co. Ltd., Osaka, Japan).

The starting position on top of the block was the feet positioned a comfortable width apart and the tips of the shoes aligned directly behind the leading edge of the block. After approximately 5 seconds in this position (looking straight ahead), the subjects were instructed to step down in a single step at their own comfortable speed coming to a stationary standing position on the lower level with their feet side by side. The subjects were free to choose where they looked when stepping. They undertook a familiarization trial at each block height wearing their own spectacles. For each block height (low, medium, and high), they repeated the trials while wearing single-vision distance, PAL, or bifocal spectacles. They were not informed which pair of spectacles they had been given. All trials were repeated three times, with the order of spectacle condition and block height randomized (height was "blocked" in three's, because of the practicalities associated with changing the step), totalling 27 trials. The subjects led with the same self-selected limb in all trials. Any trial that was not completed according to these instructions was discarded and repeated. An assistant stood close by to ensure that the subjects did not fall if they should stumble. The subjects had a seated rest each time block height was changed to minimize the onset of fatigue.

For each subject, data were collected during a single 2-hour testing session. The subjects wore their own shorts, t-shirt, and low-heeled, comfortable shoes. The five cameras, which were either wall or ceiling mounted, where positioned with approximately 70° separation and encircled the stepping area. Reflective spherical markers (25-mm diameter), with their instantaneous positions tracked by the camera system, where placed on the feet (superior aspects of the second metatarsal head, lateral malleoli, and posterior aspect of the calcanei), upper and lower legs (lateral aspects of each shank and thigh and lateral femoral condyles), pelvis (anterior superior iliac spines and sacrum), upper and lower arms (medial and lateral aspects of the wrists, lateral humeral epicondyles, and acromions), trunk (xiphoid process, jugular notch, and spinous processes of the seventh cervical and tenth thoracic vertebrae), and head (anterolateral and posterolateral aspects).

The 3-D marker trajectory data were filtered and processed as previously reported,[12] to define a 3-D linked-segment model of the subject incorporating whole-body center of mass (CM) location. Knee, ankle, and head flexion–extension angular displacement data; 3-D ground contact force data from each force platform (including magnitude and the co-ordinates of its instantaneous location); and the 3-D co-ordinate data for the whole-body CM, knee, ankle, and all foot markers were exported (at 50 Hz) for further analysis.

Data Analysis

The analysis predominantly concentrated on prelanding kinematics and the mechanics of landing. The instant of landing (lead limb foot contact with the ground) was defined as the frame in which the vertical contact force for the lead limb first increased beyond 20 N. The landing period assessed was from the instant of landing up to the instant of trail limb toe-off. Trail limb toe-off was defined as the frame in which the vertical contact force on the force platform, from which the individuals stepped, first dropped below 20 N. Prelanding kinematic measures included head, lead limb knee and ankle flexion angle; anteroposterior positioning of CM relative to feet (CM positioning); and anteroposterior, mediolateral, and vertical (downward) CM velocity for the instant of landing (for further details, see Ref. 10). Head flexion angle at lead limb heel-off and at instant of landing was also calculated, to check that the participants did not flex their heads differently across spectacle conditions at any point before or during descending the steps. The mechanics of landing were evaluated by determining peak vertical contact force (peak force), peak angular velocity at the knee and ankle joint, and peak vertical CM velocity for the landing period.

Time from movement initiation to lead limb toe-off (double-limb support), lead limb toe-off to foot contact (single-limb support), foot contact to trail limb toe-off (weight transfer), and time to peak force were also evaluated. Movement initiation was defined as the instant the resultant horizontal distance between the CM and the ground contact force's instantaneous location was greater than 20 mm. Data analysis was performed by a naive examiner who was not involved in data collection and was unaware of the specific test conditions.

Statistical Analysis

For each outcome, variable data were averaged across repetition and analyzed in relation to the following (for each outcome variable analyzed) two factors:

1. Spectacle: three levels, bifocal, PAL, and single-vision distance.
2. Block height: three levels, low, medium, and high.

For each variable, a repeated-measures ANOVA was used to assess statistical significance for each factor. Level of significance was accepted at $P < 0.05$, and post hoc analyses were performed using Tukey's honest significant difference (HSD) test.

Results

Variability was assessed by determining the standard deviation in all variables across each spectacle condition. No significant differences in variability were found. Therefore, the remainder of the results section will consider only the differences in each variable's mean across the conditions.

Head angle at lead limb heel-off was significantly affected by block height ($P < 0.001$), but there were no effects of spectacle condition and no significant interactions. Individuals increased head flexion at high compared with low and medium block heights.

Table 2. Group Mean (±SD) Prelanding Kinematics

	Single Vision	PAL	Bifocal	Significant Factor
Head angle, deg	−29.7 (13.9)	−30.3 (13.4)	−30.5 (13.0)	NA
Ankle angle, deg	−31.4 (7.5)	−32.0 (7.5)^{S}	−31.9 (7.2)^{S}	H, V
Knee angle, deg	6.7 (4.1)	6.6 (4.4)^{B}	7.1 (4.5)^{S,P}	V
CM position, % step distance	33.6 (6.4)	34.0 (6.1)	33.7 (6.7)	H*
Vertical CM velocity, mm/s	327 (109)	339 (111)^{S}	342 (107)^{S}	H*, V*
Mediolateral CM velocity, mm/s	135 (36)	123 (39)^{S}	125 (39)^{S}	H*, V*
Anteroposterior CM velocity, mm/s	377 (65)	382 (64)	382 (67)	H*

Data are averaged across block height to illustrate the effects of spectacle condition. Factors found to be significant are shown by capital letter ($P < 0.05$) and asterisks ($P < 0.001$) for spectacle type (V) and block height (H), there were no interactions between factors. Significant differences between conditions are denoted by upper case letters: single (^{S}); PAL (^{P}); and bifocal (^{B}).

Prelanding Kinematics

Ankle and knee angle and mediolateral and vertical CM velocity at the instant of landing were significantly affected by spectacle condition ($P < 0.03$, Table 2). All these dependent variables (except knee angle) increased significantly with increasing block height ($P < 0.04$). There were no significant interactions across conditions. Ankle angle and vertical CM velocity decreased and lateral CM velocity increased when subjects wore single-vision distance spectacles compared with wearing bifocals and PALs. Knee angle decreased when participants wore single-vision distance spectacles and PALs compared with wearing bifocals.

Head angle, anteroposterior CM velocity and CM positioning at the instant of landing were unaffected by spectacle condition. All these variables except for head angle were significantly affected by block height ($P < 0.001$). There were no significant interactions across conditions. Anteroposterior CM velocity increased (in the forward direction), and the CM was positioned farther forward within the base of support with increasing block height.

Landing Mechanics

Angular velocity of the knee and ankle, vertical CM velocity, and peak force during landing were significantly affected by block height ($P < 0.001$). Only angular velocity of the ankle and vertical CM velocity were significantly affected by spectacle condition ($P < 0.03$), both decreasing when wearing single-vision distance spectacles compared with bifocals (Table 3). Each variable increased with increasing block height. There was a significant spectacle×block-height interaction ($P < 0.04$) for peak force, with an increase for single-vision distance spectacles compared with bifocals, but only for the medium block.

Temporal

Double-limb support, single-limb support, and weight transfer times and time to peak force were significantly affected by block height ($P < 0.001$). Only single-limb support time and time to peak force were significantly affected by spectacle condition ($P < 0.03$, Table 4). There was also a significant spectacle×block-height interaction ($P < 0.05$) for time to peak force. Single-limb support time was increased when the subjects wore single-vision distance spectacles compared with when they wore bifocals and PALs, whereas time to peak force was reduced with single-vision distance spectacles compared with bifocals, but only when stepping from the low block height. Single-limb support time increased with each step height, and double-limb support time increased when descending high compared with medium and low block heights. Weight transfer time and time to peak force were reduced with increasing block height.

Discussion

Head flexion magnitudes and lack of any differences in head flexion before and during step descent across spectacle conditions suggests that individuals viewed the immediate lower floor area through the bottom portion of each prescribed lens. Thus when wearing single-vision distance spectacles, individuals would likely have been more certain about the precise height of the lower floor owing to having a nonblurred and/or nonmagnified view of the foot, step edge, and immediate floor area. In contrast, when the subjects wore multifocals and particularly bifocals, the near portion of the spectacles blurred and magnified their vision in the lower visual field (confirmed by the significant reductions in visual acuity, contrast sensitivity, and depth perception when individuals' vision was assessed at a distance of ~1.4 m with the near prescription lens compared with the intermediate or distance lens; Table 1). Unlike single-vision lenses, multifocal lenses create prismatic diplopia/jump (bifocals) and peripheral distortions (PALs). There were expected effects of block height,[10,12] but as these effects were generally consistent across spectacle condition, they are not discussed.

Findings suggest that compared with multifocal spectacles (bifocals or PALs), single-vision distance spectacles increased the subjects'certainty regarding the precise height of the lower floor. Findings for prelanding kinematics and the mechanics of landing indicate that when wearing single-vision distance spec-

Table 3. Group Mean (±SD) Landing Mechanics across Spectacle Conditions

	Single	PAL	Bifocal	Significant Factor
Peak force, N	861 (242)	857 (247)	854 (242)	H*, h-v
Vertical CM velocity, mm/s	−351 (128)	−359 (128)	−362 (127)^{S}	H*, V
Ankle angular velocity, deg s^{-1}	252 (85)	256 (87)	258 (83)^{S}	H*, V
Knee angular velocity, deg s^{-1}	82 (39)	86 (42)	90 (40)	H*

Data are averaged across block height to illustrate the effects of spectacle condition. Factors found to be significant are shown by capital letter ($P < 0.05$) and asterisks ($P < 0.001$) for spectacle type (V) and block height (H). Interactions between factors are denoted by lower case letters. Significant differences between conditions are denoted by upper case letters: single (^{S}); PAL (^{P}); and bifocal (^{B}).

TABLE 4. Group Mean (±SD) Results for Limb Support

	Single	PAL	Bifocal	Significant Factor
Double support, s	0.389 (0.074)	0.395 (0.077)	0.393 (0.079)	H
Single support, s	0.659 (0.098)	0.646 (0.096)^S	0.646 (0.101)^S	H*, V
Time to peak force, s	0.191 (0.080)	0.195 (0.079)	0.204 (0.090)^S	H*, V, h-v
Weight transfer time, s	0.250 (0.067)	0.247 (0.061)	0.260 (0.077)	H*

Data are averaged across block height to illustrate the effects of spectacle condition. Factors found to be significant are shown by capital letter ($P < 0.05$) and asterisks ($P < 0.001$) for spectacle type (V) and block height (H). Interactions between factors are denoted by lower case letter. Significant difference between conditions are illustrated by upper case letters: single (^{S}); PAL (^{P}); and bifocal (^{B}).

tacles, individuals had an increased single-limb support time, a reduced vertical CM velocity (at instant of contact and during landing), and a reduced peak ankle angular velocity during landing (Tables 2, 3). Despite significant reductions in vertical CM velocity in subjects wearing single-vision distance spectacles, there was no change in peak force during landing across spectacle conditions. At first these two findings seem inconsistent. However, the reduced peak ankle angular velocity and reduced time to peak force with single-vision distance spectacles compared with multifocals indicates that the reduced landing momentum was attenuated over a shorter period than that observed with multifocals, which is why peak force values were similar to those observed with multifocals (Table 3). The reduced vertical CM velocity and increased single-limb support time with single-vision distance spectacles suggests that the landing occurred in a more controlled manner, and, as a result, peak ankle and knee angular velocity during landing were reduced. In contrast, individuals wearing multifocals tended to drop onto the lower level, which caused a significant increase in all the variables mentioned (except single-limb support time which was reduced). Our present finding of adapted landing behavior when wearing multifocals is consistent with those indicating how step descent is affected by occlusion of the lower visual field.[12] The present and an earlier[12] study suggest that upper visual field information (e.g., visual exproprioceptive information regarding head position relative to the environment) can be used to effectively plan stepping strategy, but that exproprioceptive information of the foot relative to the floor (i.e., lower visual field information) is necessary for the precise control of landing.

A sideways fall during step and stair descent has been highlighted as one of the highest risk factors for hip fractures,[25] and it is known that the elderly have reduced mediolateral balance control[26] and experience more sideways falls during step and stair descent than do the young.[27] As an increase in lateral CM velocity at the instant of landing would increase the chance that the CM would move outside the base of support during landing,[28] it is likely that being uncertain regarding the precise location of the lower floor height would result in an individual's attempting to reduce their lateral CM velocity. This explanation may show why in the present study lateral CM velocity was higher when subjects wore single-vision distance lenses, with which an ability to precisely control landing meant there was little need to reduce lateral CM velocity, as was evident in the multifocal condition.

In the present study the hypothesized reduction in variability when wearing single-vision distance spectacles compared with multifocals was not observed. This finding could be attributable to the instructions given to each individual. Individuals were instructed to attain a start position with toes in line with the block's edge; thus, they would have been aware of the precise location of the block's edge and could plan their stepping pattern accordingly. Future research investigating the effects of multifocal use on step descent should consider tasking individuals with descending steps during walking.

Improvements in landing control were more pronounced when switching from bifocal to single-vision distance lenses in comparison to switching from PALs. Bifocal lenses provide a blurred and magnified image beyond approximately 40 cm when looking through the lower visual field, diplopia when viewing at the bifocal edge, and image jump when the eyes move across the bifocal edge.[29] PALs do not present diplopia or image jump. However, they do provide a blurred and magnified image beyond approximately 40 cm when looking through the lowest part of the visual field, and the peripheral parts of PAL lenses are subject to distortions (Fig. 1). Nonetheless, the upper section of the narrow corridor of the lower visual field (i.e., the mid height of the lens) is focused at intermediate distances between 50 cm and 2 m, where the lower floor level (forward of the immediate floor area) may have been viewed. The more pronounced improvements in landing control when switching from bifocal to single-vision distance lenses in comparison to switching from PALs suggests that prismatic diplopia/jump caused greater uncertainty than peripheral distortions did, or that the intermediate distance portion of PALs provided more visual information regarding floor height (average, 1.4 m) than that obtained with bifocals. However, the strength of any conclusions regarding the differences between bifocals and PALs is limited by the small number of subjects included and should be investigated further.

In summary, when older adult long-term multifocal wearers used single-vision distance spectacles, control of step descent was improved. This result was attributed to the individuals' being more certain about the precise height of the lower floor level owing to a view of the lower visual field that was not blurred or magnified, with no image diplopia or jump and no peripheral distortions. In contrast, when wearing multifocals, individuals tended to drop onto the lower level rather than having a controlled landing. The study suggests that step descent is more controlled when wearing single-vision distance spectacles compared with either bifocals or PALs. This finding highlights the need for randomized controlled trials to determine whether fall rates can be reduced when older, frail multifocal wearers use single-vision distance spectacles during everyday locomotion.[30]

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