THE COLLEGE OF OPTOMETRISTS

Professional Excellence in Eye Health

The importance of vision in preventing falls

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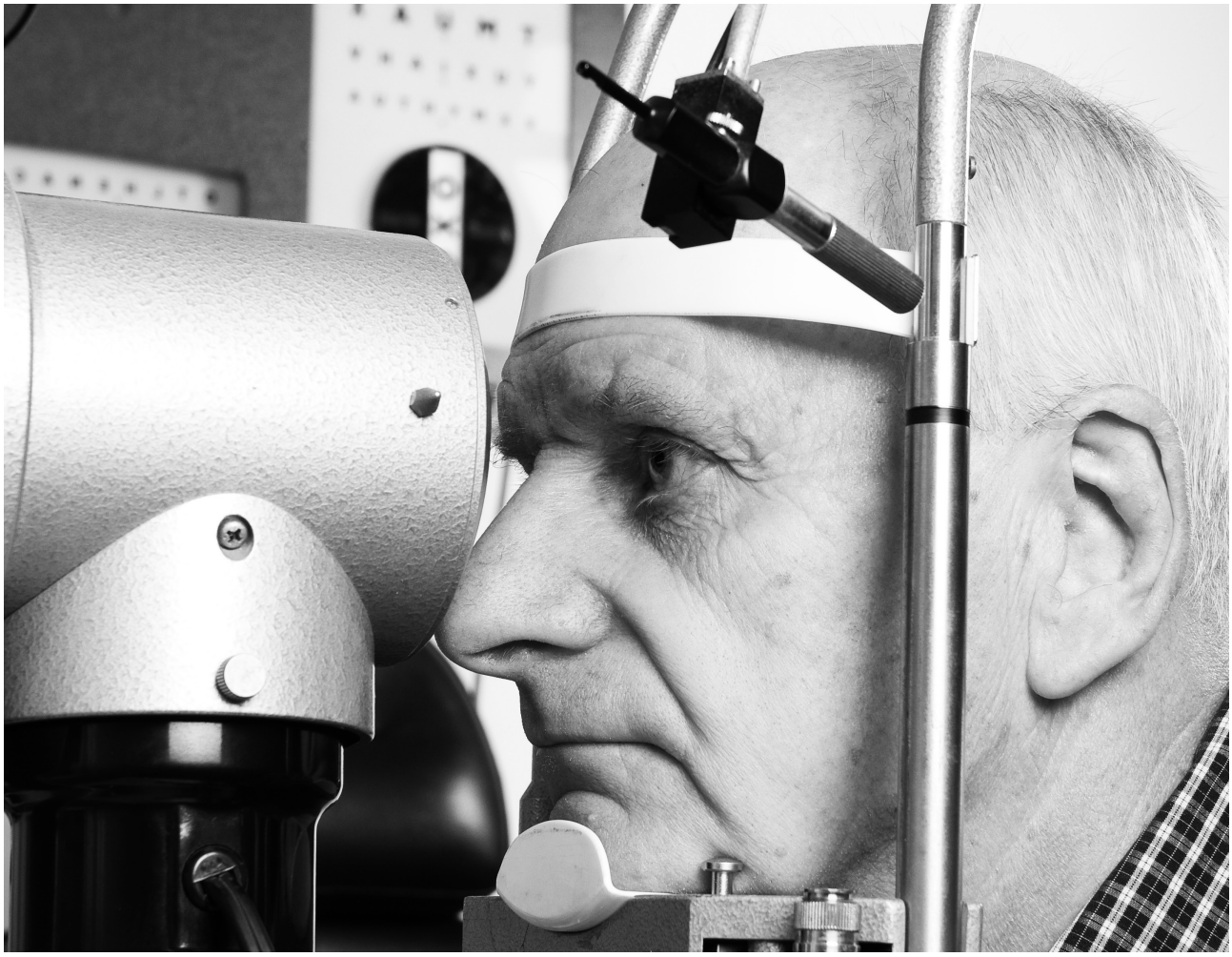
Introduction

Much has changed since The Importance of Vision in Preventing Falls was first written in 2003 and revised in 2011. The original guidance was aimed at commissioners and was designed to highlight the link between falls and visual impairment, including those caused by cataract, diabetes, glaucoma, macular degeneration and refractive error.

Since then we are pleased to see progress. We have worked with UK Falls Services to help them identify and support patients with failing vision and research has given us more information on which refractive interventions are more likely to reduce falls. This version of our guidance on preventing falls aims to help optometrists identify which patients are more likely to fall and gives practical advice on what they can do to reduce the chances of patients falling.

We are grateful to Professor David Elliott of the University of Bradford, Professor Joanne Wood and Dr. Alex Black of the School of Optometry and Vision Science at Queensland University of Technology, Brisbane, Australia, for writing this guidance for us.

We would also like to thank Age UK, the British Geriatric Society and the Royal College of General Practitioners for endorsing this report. We hope it will help raise awareness among all healthcare professionals about the importance of vision in preventing falls.



Guidelines for optometrists to help prevent falls in older patients

Falls are defined as "an unexpected event in which the participant comes to rest on the ground, floor or lower level." Many factors have been linked to falls risk. Of these factors, problems with vision are one of the most important and some of these vision problems can be avoided or are reversible.[1,2] This publication provides optometrists and other health care professionals with a current overview of the importance of vision in preventing falls, along with recommendations for optometrists regarding how to best manage their older patients to minimise the risk of falls.

Falls and their consequences in older people

Falls are common in older people, with at least a third of people over the age of 65 reporting falling at least once per year, with about half of these people reporting multiple falls.[3-5] Falls rates are higher in older and frailer people, being about 60% in people over 90 years age and in those that live in care homes.[3-5] With increasing age the incidence of fall-related hospital admissions increases exponentially; by the of age of 65 years approximately 57% of all admissions are due to fall-related injury.[3] The mortality rate associated with falls also greatly increases with age, with falls accounting for 84% of accidental deaths in persons 65 years and over.[3] Falls can also lead to "long lies", where people can remain on the floor for over an hour following a fall, which is more common in frail and/or ill older people who live alone and can have devastating psychological consequences with loss of confidence and reluctance to venture outside the home being common responses.[3] This can lead to social isolation, with fear of falling even deterring excursions such as shopping trips and avoidance of activities in the house such as bathing and dressing.[3] Falling thus represents a high-risk problem for the older population, and as the ageing population continues to increase, the impact on related health care costs will become considerable.

Falls are not chance events

Falls have traditionally been viewed as accidents that are unpredictable and, therefore, unavoidable. However, there is clear evidence that although falls in older people are multifactorial, they are associated with well-defined intrinsic and/or extrinsic factors. A list of intrinsic and extrinsic factors associated with falls in older adults are shown in Table 1.[3-5] The more risk factors you have, the more likely you are to fall. For example, Tinetti and colleagues[4] reported that the falls rate was about 8% for people with no falls risk factors and increased with each additional risk factor. In people with four or more risk factors, the falls rate rises to around 78%. Extrinsic factors, many of which are related to aspects of the physical environmental, are also important contributing factors for falls (Table 1).

Visual impairment increases the risk of falls

The prevalence of visual impairment in the UK increases with increasing age, with ~6% of adults aged 60-69 years having impaired visual acuity (binocular 6/18 or worse), rising to 37% in those aged 90 years and above.[6] Visual impairment is classified as

Intrinsic Risk Factors	Extrinsic Risk Factors
Increasing age	Poor lighting
Female sex	Presence of trip hazards such as loose rugs
Gait and balance impairment	Inappropriate footwear
Systemic conditions such as arthritis, postural hypotension, stroke, diabetes and Parkinson's disease	Unsafe stairways (no handrail and steps of variable height)
Sedative use	Irregular floors
Taking multiple medications (greater than four, polypharmacy)	Unsuitable bed and bath designs
A history of falls	
Visual impairment	

Table 1. Risk factors for falls[3-5]

those levels that can impact on the ability to undertake everyday tasks, and is typically defined as binocular visual acuity worse than 6/12 (20/40; WHO, USA) or 6/18 (UK). There are several epidemiological studies that highlight the role of visual impairment as a risk factor for falls.[1-3] An important statistic highlighted by these studies is that most of the visual impairment in patients admitted to hospital following a fall (around 75%) is correctable, either by updating a spectacle prescription or the surgical removal of cataract.[7,8] Other epidemiological studies have also shown that uncorrected refractive error and cataract are the main causes of reversible vision impairment in older adults even in developed countries.[9]

Importantly, irreversible vision loss is also strongly associated with falls risk, highlighting the importance of early diagnosis and treatment of eye disease. Central visual impairment due to age-related macular degeneration, one of the main causes of irreversible visual loss in older adults, increases falls risk, particularly injurious falls.[10,11] Visual field defects also increase falls risk,[12-15] likely due to impaired detection and avoidance of obstacles/hazards in the periphery. Severe binocular field loss was found to be associated with a 1.5x increase in falls in older women,[12] while another study indicated that visual field loss was the leading visual risk factor for falls.[15] Importantly, field loss in the inferior region has been linked to increased falls risk, potentially because it provides important visual information for foot placement and obstacle detection when walking.[16] Research is ongoing as to how best to advise patients to cope with visual field loss, but in the meantime eye care interventions that reduce the rates of reversible and irreversible visual impairment could significantly reduce the number of falls occurring in older people.

The link between poor vision and falls

The most obvious way that vision impairment increases the risk of falls is through increasing the likelihood of tripping over obstacles in the travel path or misjudging the position of step edges or kerbs. Indeed, stairs, steps and kerbs are the most common causes of falls in older people with poor vision.[17,18] In addition, vision provides key sensory input for the control of balance. Postural stability or balance is also controlled by the somatosensory system, which provides information from the feet and legs and vestibular system regarding the position of the body in relation to gravity and movement. Postural stability is poorer when the eyes are closed as the patient then has to rely solely on somatosensory and vestibular system information. Importantly, balance control is more reliant on visual input when information from the somatosensory and vestibular systems are poor (for example, in patients with diseases such as peripheral neuropathy in diabetes or Meniere's disease).[19] Older people with vision impairment tend to adopt cautious strategies when negotiating stairs: they tend to step more slowly so that a trip is less likely to become a fall, and lift their foot higher to avoid catching the step edge.[20] While these strategies help, it also means that the person stepping is in the single support phase (only one leg is on the floor while the other leg swings over the step edge) of the step for longer which is the most dangerous part of the step phase and may make sideways falls more likely.[21]

Evidence from studies of eye care interventions to reduce falls

Several trials that have evaluated the potential benefits of eye care interventions to prevent falls, yet these have not shown the expected reductions in falls rate.

The most unexpected, but perhaps most revealing, is a randomized controlled trial (RCT) by Cumming and colleagues.[22] Their trial included about 600 people, half who received an eye care intervention (92 received new spectacles and 15 referred for cataract surgery) and the other half were the control group, left to their 'usual care'. Their findings were the opposite of those expected, in that the intervention group falls rate increased, when compared to the control group. The most likely explanation is that this was caused by adaptation problems for some of the participants who received large changes in refractive correction in their spectacles. 74% of participants who received a large change in correction (defined as greater than 0.75D, axis changes of ≥10° up to 0.75DC and ≥5° for 0.75DC+, any prism change or an introduced anisometropia of ≥0.75DS) fell at least once, compared to 53% of those who had received smaller changes in refractive correction.[22] The trial also did not include expedited cataract surgery, and only 7 of the 15 referred for cataract surgery received treatment during the trial.

Several studies have examined the effect of cataract surgery for reducing falls rates with mixed results.[23-26] While two recent Australian prospective cohort studies[25,26] and one UK RCT[23] reported significant reduction in falls following surgery, other studies have failed to find improvements in falls rates. This is likely to be because any improved visual function due to cataract removal is offset by increased risk of falling due to large changes in refractive correction.[2,24,25,27] The large refractive changes that occur following some cataract surgeries can increase falls risk as can re-adapting to bifocals and PALs many months after not wearing them prior to, and immediately following, cataract surgery.[2,24] Optometrists therefore play a particularly important role in ensuring that adaptation to refractive correction following cataract surgery is as easy as possible.

Why might some new spectacles increase falls?

Large changes in refractive correction provide improvements in vision, but can also provide changes such as magnification and distortion that older people in particular can find difficult to adapt to.[28] Normal age-related changes in refractive correction include a hyperopic shift and a change in astigmatism from with-the-rule to against-the-rule. However, larger changes in correction can occur with cataract, with nuclear cataract providing myopic shifts and cortical cataract producing astigmatic changes in cylinder power and/or axis.[29] Astigmatic changes cause distortion, with patients complaining of floors and doors sloping,[28] and oblique astigmatic changes increasing symptoms of dizziness,[24] with obvious ramifications regarding mobility and falls. Hyperopic shifts provide additional magnification, while myopic shifts cause additional minification. These might not seem to be that significant, until consideration is given to the accuracy needed to negotiate steps

and stairs and avoid hitting a step edge.[18,20,21] With magnification from positive lenses, steps look closer and bigger so that prior to adaptation, older people place their leading foot further from the step and often place their foot on the step with their heel hanging over the edge.[30] With minification from negative lenses, steps look further away and smaller so that prior to adaptation, older people place their leading foot closer to the step, only just clear the step edge with their feet and land a long way onto the step.[30] Both adaptations increase the risk of tripping and/or losing balance.

Magnification with new spectacles also cause changes to the vestibulo-ocular reflex, which links head movements to directly opposite eye movements, so that the view of the world doesn't change when your head moves: if your head moves up, the vestibulo-ocular reflex moves your eyes down at exactly the same speed.[2,28] However, when the magnification of spectacles changes, this reflex is disrupted and the eye muscles need to change their speed of movement to precisely match head movements. Until this adaptation occurs, the patient's view of the world will "swim" a little during head movements.[2,28]

Bifocals, progressive addition lenses and falls

Accident and epidemiological studies have indicated that bifocals and progressive addition lens (PALs or progressives) wearers have a higher risk of 'edge of step' accidents[31] and frail, older bifocal and PAL wearers are twice as likely to fall compared to single vision lens wearers.[32] A large proportion of falls are reported to occur outside the home, presumably due to tripping over obstacles not seen because of blur in the lower visual field from the near vision correction.[32] It has been shown that the lower visual field is particularly linked to falls risk.[16] This effect is greatest in older people when the near addition power is higher and the range of clear vision when viewing the ground is most restricted. Optometrists typically encourage patients who wear bifocals or PALs to "tuck their chin in" when stepping over kerbs or going up and down stairs, so that they can look through the distance portion of their spectacles, to provide a reasonably clear view of kerbs/stairs. However, this strategy does not appear to be used by people who have worn bifocals and PALs for many years.[33]

Other attributes of bifocals that may lead to a greater risk of falls include image jump over the bifocal edge. Some texts also suggest an accompanying visual field loss, although Walsh[34] suggests there is actually diplopia at the edge itself; diplopia and image jump vary with add power and segment type and are largest for high powers worn by older patients and with large round segment bifocals.[33] Other attributes of PALs that may lead to a greater risk of falls include the peripheral distortions, which are again greatest when the add power is higher. Laboratory-based studies have shown that long-term PAL and bifocal wearers use much more variable foot placements when stepping up or down and are more likely to hit the step edge than when they are provided with single vision spectacles incorporating their distance prescription only.[33] An Australian RCT of an intervention of an additional distance-only single vision pair of spectacles for outdoors wear versus a control condition of 'usual care' of long term bifocal and PAL wearers suggested that for active participants, there was a reduction in falls in the intervention group.[35] However, it must also be noted that inactive participants who received the additional single vision glasses actually had an increased rate of falls.[28]

In addition, it appears that the single vision spectacles prescribed in the study were tinted or photochromic (likely offered to help recruitment to the study as the researchers found it difficult to persuade people to swap their bifocal/PAL for single vision lenses, even just for outdoor use), so that it could be argued that any improvement in falls rate could have been due to a combination of distance-only single vision lenses and reduced glare resulting from the tint.

Optometric guidelines for older patients

1. Adaptation of the case history

1.1. It is important to understand which patients are most at risk of falling, based on the risk factors shown in Table 1. The presence of more risk factors increases the risk of future falls.[3-5]
1.2. The case history should include determination of any history of falls in the previous 12 months, as this is an important risk factor. It is worth noting that the patient may not directly attribute their falls to their vision.
1.3. It is important to find out when spectacles are actually worn and particularly whether older patients always wear their distance spectacles when walking outside the home.
1.4. Similarly, it can be useful to determine whether bifocal/PAL wearers report any problems with steps and stairs when wearing their spectacles and whether they remove their bifocal/PALs when negotiating stairs.[2]

2. Management of patients at moderate-high risk of falling

2.1. Promoting regular eye exams can be useful, so that regular small changes in refractive correction can be made thus avoiding the need for larger changes in correction, which have been shown to lead to increased falls.[2,22,25,28]
2.2. Suggest early referral for first eye cataract surgery as appropriate.[23,18,19]
2.3. Advise 'at-risk' patients to keep their distance spectacles on when walking outside the home as this could reduce the fall risk. Note that unaided low myopes will have a clear view of the travel pathway, steps and stairs when viewing the ground-level at 1-1.5m.
2.4. Warn patients of magnification changes with new spectacles. Myopic shifts will make objects, including steps and stairs, look smaller and further away, while hyperopic shifts will make steps and stairs look bigger and closer and astigmatic changes will make stairs and steps slope.[24,30]
2.5. Patients with visual impairment should be advised to seek home modifications to prevent falls[36] via local falls teams. The College of Optometrists provides a falls directory that includes details of falls services teams throughout the UK.

3. Prescribing to patients at moderate-high risk of falling

3.1. Any change in refractive correction should be conservative. Be very careful in changing the correction of an 'at-risk' patient by more than 0.75DS.[2,22,28,37]

3.2. Be very careful in making astigmatic changes, particularly if oblique. Make partial changes in cylinder and axis as appropriate and provide appropriate advice to patients regarding these changes.[2,22,28,37]

3.3. Be wary of using a monovision approach with 'at-risk' patients because of the loss of stereoacuity.[38]

3.4. Do not prescribe bifocal/PALs if 'at-risk' patients currently wear single vision spectacles or if 'at-risk' patients are emmetropic or minimally ametropic and are used to walking about without spectacles.[35]

3.5. Long-term wearers of bifocal/PALs with minimal ametropia can be advised that they are less likely to fall if they remove their spectacles when walking outside their own home. If they have significant ametropia and participate in frequent outdoor activities, they should use additional distance single vision spectacles when outside their own home (other than when driving or shopping); prescription single vision sunglasses may be useful.[2,35]

3.6. Long-term wearers of bifocal/PALs with significant ametropia who take part in little outdoor activity should continue to wear bifocal/PALs for most activities.[35]

4. Prescribing to patients following cataract surgery

4.1. Ensure that the patient is involved in the decision making regarding their post-operative refractive error. For example, some long-term myopes who have been myopic all their life might wish to remain myopic after surgery so that they can continue to read without correction, rather than become emmetropic for distance but need spectacles for reading. This would also reduce the magnitude of change in refractive error following surgery, which may reduce falls rate.[18]

4.2. Make conservative changes in refractive correction,[2,22,24,25,27,28] particularly astigmatic correction.[2,24,39] Any astigmatic correction should be kept the same as pre-surgery if possible, particularly the axis. Otherwise, the overall cylinder value should be reduced and if there are small differences in cylinder power between the eyes, give equal powers (so if the cylinder powers are 0.50 and 0.75, prescribe 0.50 DC R and L). If the cylinder power is low and the axis oblique, consider prescribing the best vision sphere if this does not significantly impact upon the patient's visual acuity (for example for driving).[2,24,39]

4.3. Reduce the use of bifocals and PALs in active older patients.[24,35]

4.4. Provide reduced reading power bifocals/PALs that provide safer walking but allow adequate short-term reading[40] for patients who wish to retain bifocals/PALs. This could be combined with a full addition bifocal/PAL or reading spectacles for near work.

4.5. Ensure the patient has appropriate spectacles after first eye surgery if:
- there is going to be a significant wait for them to have their second cataract removed, and
- the patient has significant ametropia, in particular astigmatism, such that they would wear spectacles for walking about outside, or
- the patient intends to wear multifocal spectacles for walking after second eye surgery. The option of not wearing spectacles between surgeries for multifocal wearers increases falls risk so should be avoided where possible.[2,17] This may be due to the need for the patient to adapt to being without spectacles between surgeries, and then re-adapting to new multifocals after second eye surgery.[17]

4.6 If the patient has significant anisometropia following first eye surgery, options for managing this before second eye surgery include:
- correcting the operated eye and providing a temporary balance lens for the other (cataractous) eye, or
- if the patient does not need a distance prescription in their operated eye, fitting them with a contact lens in their cataractous eye, to enable them to manage without distance spectacles.

The final refractive solution can then be reassessed after second eye surgery. Suggesting that either the operated (or non-operated) eye spectacle lens is removed as a temporary measure may lead to patients wearing such spectacles indoors, but then not wearing any spectacles outdoors. This may not be ideal due to adaptation problems (including the vestibulo-ocular reflex) when walking indoors (with spectacles) and outdoors (without spectacles), particularly if the patient is wearing multifocals.

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