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Original Article

Impact of Cataract Surgery on Functional Balance Skills of Adults

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Abstract

Objectives: To investigate the impact of phacoemulsification surgery and intraocular lens implantation on the functional balance skills of adults.

Materials and Methods: This prospective study included patients with cataract who were recommended phacoemulsification surgery and intraocular lens implantation between May and October 2016. The Berg Balance Scale and Tinetti Gait and Balance Test were performed by a physical therapy specialist before and 1 month after surgery. Patients were analyzed in terms of age, visual acuity, and balance. Balance scores before and after cataract surgery were compared. We also compared patients with high (≤2 LogMAR) and low (>2 LogMAR) visual acuity. P values below 0.05 were accepted as statistically significant.

Results: Fifty-one patients (27 female and 24 male, mean age 66.96 years) were included in the study. One month after surgery, the patients' Berg Balance scores and Tinetti Gait and Balance scores were increased by 3.60±5.00% and 4.14±6.55%, respectively. Postoperative increase in visual acuity was significantly greater in the 16 patients with visual acuity less than 0.05 (>2 LogMAR) (p=0.036), but balance scores were not significantly different.

Conclusion: Visual acuity is significantly improved one month after cataract surgery, which also leads to significant increases in low functional balance scores among patients with poorer vision. The rapid increase in vision after cataract surgery enhances balance skills, resulting in safer mobility and increased quality of life.

Keywords: Vision, cataract, balance, phacoemulsification, falls

Introduction

Cataract is a treatable condition that generally emerges in old age and is a leading cause of vision loss. Today, increases in education level and the average human lifespan are increasing the demand for cataract surgery. In addition to reduced vision, cataracts also cause visual problems such as glare, defects in color vision, and loss of contrast sensitivity and depth perception. These symptoms lead to problems such as loss of balance, less independent mobility, falls, injuries, and increased mortality risk in individuals with visual impairment.[1] Every year, approximately 646,000 people worldwide lose their lives due to falls, and according to a report from the World Health Organization, falls are the second most common cause of injury-related deaths.[2] Furthermore, the daily activities of elderly patients are affected and patient's quality of life is impaired.[3] Cataract surgery is now performed not only to treat blindness, but to improve quality of life. Atasavun and Akı[4] reported that studies in different age groups have shown that the incidence of falls is higher among the visually impaired than among individuals with auditory

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impairment or with no visual impairment. According to 2016 data from the Australian Institute of Health and Welfare, falls become a common problem over the age of 65 and are one of the leading causes of accidental deaths (40% for men and 66% for women).[5] Other studies have shown that an average of 30% of older adults fall once a year and 20% of them are hospitalized as a result of these falls.[6,7]

Although there are various studies in the literature evaluating the relationship between vision and balance, some of these studies have not demonstrated functional balance, while vision was not evaluated objectively in others.[8] The relationship between vision and balance cannot be fully elucidated without an objective assessment of vision level, especially for patients with low vision.[9] Some studies involved retrospective evaluations of surveys conducted in patients who had history of falls. However, various factors may be overlooked in these studies due to inaccurate recollection of events. In addition, because balance is affected by many parameters such as age, sex, muscle strength, vestibular function, medication use, and comorbidities, it is difficult to form a well-matched control group and establish a direct relationship between vision and balance.[10] Therefore, in the present study, we prospectively enrolled a group of patients whose characteristics did not differ except for vision. By evaluating these patients before and after cataract surgery, the relationship between vision and balance was revealed more clearly, without confounding by other variables.

In this study, we investigated the effect of vision increase in adult cataract patients after phacoemulsification surgery and intraocular lens implantation on functional balance skills.

Materials and Methods

Adult patients with cataract who were recommended phacoemulsification and intraocular lens implantation in our center between May and October 2016 were enrolled in the study. The study was designed in accordance with Declaration of Helsinki criteria and each participant signed an informed consent form before the study. The study was approved by the Antalya Training and Research Hospital ethics committee.

Exclusion criteria for the study were presence of chronic diseases such as rheumatoid arthritis or osteoarthritis, immobility with or without assistive devices or severe lower extremity deformities that might affect mobility, vestibular problems, history of stroke, and presence of dementia or memory problems.

Demographic data such as age, sex, marital status, education level, and occupation were determined for the individuals who met the study criteria and agreed to participate in the study. The patients' corrected visual acuity was assessed using Snellen E chart before and after cataract surgery. Functional balance was evaluated by the same physical therapist before and one month after surgery using the Berg Balance Scale (BBS) and Tinetti Gait Test (TGT) and Tinetti Balance Test (TBT).[11,12]

Berg Balance Scale: Designed primarily to assess balance and determine risk of falls in older adults, the BBS consists of 14 items for direct observation of performance. A ruler, stopwatch, chair, step, an area that allows 360 degrees of rotation, and 15-20 minutes are needed to perform the BBS. Each item is scored 0-4 according to the patient's ability to meet the time and distance requirements of the test. A score of 4 indicates ability to complete the task independently. The maximum score is 56. A score of 0-20 is interpreted as poor balance, 21-40 as acceptable balance, and 41-56 as good balance (Figure 1).

Tinetti Gait and Balance Tests: This test is preferred for determining the risk of falls, especially in the elderly, and consists of 13 items for balance and 9 items for gait. Items are scored binarily (0 or 1) or on a 3-point scale (0-2). Scores are calculated over a maximum of 16 for balance and 12 for gate, for a maximum total score (gait + balance) of 28 (Figure 2).

Statistical Analysis

The research data were entered into a spreadsheet file and evaluated with Microsoft® Excel® for Mac 2011 version 14.5.9 (151119) and Statistical Package for the Social Sciences version 20 (SPSS 20) (IBM, New York, USA) software. Female and male patients were compared in terms of age, visual acuity, and balance using Mann-Whitney U test. Relationships between the parameters of age, visual acuity, and balance were evaluated with Pearson correlation analysis. Balance scores before and after cataract surgery were compared using dependent-samples t-test. Patients with high (<2 LogMAR) and low (>2 LogMAR) preoperative visual acuity were compared using independent-samples t-test. Values associated with balance were analyzed with one-way ANOVA. P values less than 0.05 were considered statistically significant.

Results

This prospective study included a total of 51 patients, 27 (52%) women and 24 (48%) men, who met the inclusion criteria. Their mean age was 66.96 (33-87 years). There were no significant differences between the male and female patients in terms of age or preoperative and postoperative visual acuity (Table 1). Mean preoperative visual acuity was 1.32±0.75 (0.3-2.5) LogMAR. Visual acuity increased significantly in both groups postoperatively (p<0.001).

Both male and female patients also showed significant postoperative improvements in balance. At postoperative 1 month, BBS scores were increased by 3.60±5.00% (0-20%), while TGT and TBT were increased by 4.14±6.55% (0-38.46%). The increase in TGT and TBT scores was found to be statistically significant (Table 2).

Comparison based on preoperative visual acuity revealed a significantly greater increase in postoperative 1-month visual acuity among the 16 patients in the >2 LogMAR (<0.05) group compared to the 35 patients in the ≤2 LogMAR (≥0.05) group (p=0.036). However, there was no significant difference between these two groups in terms of increase in balance and gait scores (Table 3).

1. SITTING TO STANDING
INSTRUCTIONS: Please stand up. Try not to use your hands for support.
( ) 4 able to stand without using hands and stabilize independently
( ) 3 able to stand independently using hands
( ) 2 able to stand using hands after several tries
( ) 1 needs minimal aid to stand or to stabilize
( ) 0 needs moderate or maximal assist to stand
2. STANDING UNSUPPORTED
INSTRUCTIONS: Please stand for two minutes without holding.
( ) 4 able to stand safely 2 minutes
( ) 3 able to stand 2 minutes with supervision
( ) 2 able to stand 30 seconds unsupported
( ) 1 needs several tries to stand 30 seconds unsupported
( ) 0 unable to stand 30 seconds unassiste
If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported.
Proceed to item #4.
3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL
INSTRUCTIONS: Please sit with arms folded for 2 minutes.
( ) 4 able to sit safely and securely 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds
4. STANDING TO SITTING
INSTRUCTIONS: Please sit down.
( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assistance to sit
5. TRANSFERS
INSTRUCTIONS: Arrange chairs for a pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.
( ) 4 able to transfer safely with minor use of hands
( ) 3 able to transfer safely definite need of hands
( ) 2 able to transfer with verbal cueing and/or supervision
( ) 1 needs one person to assist
( ) 0 needs two people to assiste to be safe
6. STANDING UNSUPPORTED WITH EYES CLOSED
INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.
( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays steady
( ) 0 needs help to keep from falling
7. STANDING UNSUPPORTED WITH FEET TOGETHER
INSTRUCTIONS: Place your feet together and stand without holding.
( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand for 1 minute with supervision
( ) 2 able to place feet together independently but unable to hold for 30 seconds
( ) 1 needs help to attain position but able to stand 15 seconds with feet together
( ) 0 needs help to attain position and unable to hold for 15 second
8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the finger reaches while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)
( ) 4 can reach forward confidently >25 cm (10 inches)
( ) 3 can reach forward >12 cm safely (5 inches)
( ) 2 can reach forward >5 cm safely (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support
9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper which is placed in front of your feet.
( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5cm (1-2 inches) from slipper and keeps balance independently
( ) 1 unable to pick up and needs supervision while trying
( ) 0 unable to try/needs assist to keep from losing balance or falling
10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward left shoulder. Repeat to the right.
Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.
( ) 4 looks behind from both sides and weight shifts well
( ) 3 looks behind one side only other side shows less weight shift
( ) 2 turns sideways only but maintains balance
( ) 1 needs supervision when turning
( ) 0 needs assist to keep from losing balance or falling
11. TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
( ) 4 able to turn 360 degrees safely in 4 seconds or less
( ) 3 able to turn 360 degrees safely one side only in 4 seconds or less
( ) 2 able to turn 360 degrees safely but slowly
( ) 1 needs close supervision or verbal cueing
( ) 0 needs assistance while turning
12. PLACING ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times.
( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
( ) 3 able to stand independently and complete 8 steps in >20 seconds
( ) 2 able to complete 4 steps without aid with supervision
( ) 1 able to complete >2 steps needs minimal assist
( ) 0 needs assistance to keep from falling/unable to try
13. STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width)
( ) 4 able to place foot tandem independently and hold 30 seconds
( ) 3 able to place foot ahead of other independently and hold 30 seconds
( ) 2 able to take small step independently and hold 30 seconds
( ) 1 needs help to step but can hold 15 seconds
( ) 0 loses balance while stepping or standing
14. STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding.
( ) 4 able to lift leg independently and hold >10 seconds
( ) 3 able to lift leg independently and hold 5-10 seconds
( ) 2 able to lift leg independently and hold = or >3 seconds
( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently
( ) 0 unable to try or needs assist to prevent fall
TOTAL SCORE (Maximum = 56:)________

Figure 1. Berg Balance Scale

Discussion

Vision is one of the most important factors in maintaining balance and preventing falls. Kulmala et al.[13] demonstrated in their study of elderly women that visual impairment had the greatest impact on falls when compared with other sensory impairments. This finding was attributed to the fact that other senses can somewhat compensate for deficiencies by filling in gaps regarding posture and balance. In a study performed in Turkey, it was shown that individuals with visual impairments accounted for a significantly higher proportion of a group of adults with fall-related extremity fractures (78.6%) compared to the control group (38.1%).[14] This led the authors to conclude that first assessing vision and treating any detected impairments is imperative for the prevention of falls and accidents. These studies demonstrate that the incidence of fall-related fractures can be reduced through regular eye examination in adults, regular use of eyeglasses among patients with refractive error, and timely interventions for treatable eye disorders, primarily cataracts. A study of 1361 individuals in China also indicated that corrected visual acuity lower than 0.5 in the better-seeing eye significantly increased the incidence of falls.[15]

In the present study, all patients exhibited significant visual improvement at 1-month follow-up after cataract surgery, consistent with the literature.[16] In addition to postoperative increase in vision, our patients also had higher balance scores on the BBS and TBT. This suggests that the risk of falls will decrease as a result of higher balance scores associated with improved vision.

According to the results obtained from all of the balance tests used, we observed that the women had lower balance scores than the men in our study. To et al.[17] also reported that the incidence of falls was three times higher in females than males in their 2014 study. However, when we analyzed postoperative changes in balance scores, we found that balance scores increased more among the women in our study. The increase in TBT scores was statistically significantly in females ($p=0.003$) but not in males.

		Response	
Maneuver	Normal	Adaptive	Abnormal
Sitting balance	Steady, stable	Holds onto chair to keep upright	Leans, slides down in chair
Arising from chair	Able to arise in a single movement without using arms	Uses arms (on chair or walking aid) to pull or push up; and or moves push up; andlor moves attempting to arise	Multiple attempts required or unable without human assistance
Immediate standing balance (first 3-5s)	Steady without holding onto walking aid or other object for support	Steady, but uses walking aid or other object for support	Any sign of unsteadinesst
Standing balance	Steady, able to stand with feet together without holding object for support	Steady, but cannot put feet together	Any sign of unsteadiness regardless of stance or holds onto object
Balance with eyes closed (with feet as close together as possible)	Steady without holding onto any object with feet together	Steady with feet apart	Any sign of unsteadiness or needs to hold onto an object
Turning balance (360")	No grabbing or staggering; no need to hold onto any objects; steps are continuous (turn is a flowing movement)	Steps are discontinuous (patient puts one foot completely on floor before raising other foot)	Any sign of unsteadiness or holds onto an object
Nudge on sternum (patient standing with feet as close together as possible, examiner pushes with light even pressure over sternum 3 times; reflects ability to withstand displacement)	Steady, able to withstand pressure	Needs to move feet, but able to maintain balance	Begins to fall, or examinerhas to help maintain Begins to fall, or examiner balance
Neck turning (patient asked to turn head side to side and look up while standing with feet as close together as possible)	Able to turn head a t least half way side to side and be able to bend head back to look at ceiling; no staggering, grabbing, or Symptoms of lightheadedness, unsteadiness, or pain	Decreased ability to turn side to side to extend neck, but no staggering, grabbing, or symptoms of lightheadedness, unsteadiness, or pain	Any sign of unsteadiness or symptoms whenq turning head or extending neck
One leg standing balance	Able to stand on one leg for 5 s without holding object for support		Unable
Back extension (ask patient to lean back as far as possible, without holding onto object if possible)	Good extension without holding object or staggering	Tries to extend, but decreased ROM (compared with other patients of same age) or needs to hold object to attempt extension	Will not attempt or no extension seen or staggers
Reaching up (have patient attempt to remove an object from a shelf high enough to require stretching or standing on toes)	Able to take down object without needing to hold onto other object for support and without becoming unsteady	Able to get object but needs to steady self by holding on to something for support	Unable or unsteady
Bending down (patient is asked to pick up small objects, such as pen, from the floor)	Able to bend down and pick up the object and is able to get up easily in single attempt without needing to pull self up with arms	Able to get object and get upright in single attempt but needs to pull self up with arms or hold onto something for support	Unable to bend down or unable to get upright after bending down or takes multiple attempts to upright
Sitting down	Able to sit down in one smooth movement	Needs to use arms to guide self into chair'or not a smooth movement	Falls into chair, misjudges distances (lands off center)

ROM = range of motion.
'The patient begins this assessment seated in a hard, straight-backed, armless chair.
tunsteadiness defined as grabbing at objects for support, staggering, moving feet, or more than minimal trunk sway.

Componentst	Normal	Abnormal
Initiation of gait (patient asked to begin walking down hallway)	Begins walking immediately without observable hesitation; initiation of gait is single, smooth motion	Hesitates; multiple attempts; initiation of gait not a smooth motion
Step height (begin observing after first few steps: observe one foot, then the other; observe from side)	Swing foot completely clears floor but by no more than 1-2 in	Swing foot is not completely raised off floor (may hear scraping) or is raised too high (> 1-2 in)
Step length (observe distance between toe of stance foot and heel of swing foot; observe from side; do not judge first few or last few steps; observe one side at a time)	At least the length of individual's foot between the stance toe and swing heel (step length usually longer but foot length provides basis for observation)	Step length less than described under normal
Step symmetry (observe the middle part of the patch not the first or last steps; observe from side; observe distance between heel of each swing foot and toe of each stance foot)	Step length same or nearly same on both sides for most step cycles	Step length varies between sides or patient advances with same foot with every step
Step continuity	Begins raising heel of one foot (toe off) as heel of other foot touches the floor (heel strike); no breaks or stops in stride; step lengths equal over most cycles	Places entire foot (heel and toe) on floor before beginning to raise other foot; or stops completely between steps; or step length varies over cycles
Path deviation (observe from behind; observe one foot over several strides; observe in relation to line on floor (eg, tiles) if possible; difficult to assess if patient uses a walker)	Foot follows close to straight line as patient advances	Foot deviates from side to side or toward one direction§
Trunk stability (observe from behind; side to side motion of trunk may be a normal gait pattern, need to differentiate this from instability)	Trunk does not sway; knees or back ate not flexed; arms are not abducted in effort to maintain stability	Any of preceding features present§
Walk stance (observe from behind)	Feet should almost touch as one passes other	Feet apart with steppingll
Turning while walking	No staggering; turning continuous with walking; and steps are continuous while turning	Staggers; stops before initiating turti; or steps are discontinuous

*The patient stands with examiner at end of obstacle-free hallway. Patient uses usual walking aid. Examiner asks patient to walk down hallway at his or her usual pace. Examiner observes one component of gait at a time (analogous to heart examination). For some components the examiner walks behind the patient; for other components, the examiner walks next to patient. May require several trips to complete.
tAlso ask patient to walk at a "more rapid than usual" pace and observe whether any walking aid is used correctly (see text for discussion). tAbnormal gait finding may reflect a primary neurologic or musculoskeletal problem directly related to the finding or reflect a compensatory maneuver for other, more remote problem.
§Abnormality may be corrected by walking aid such as cane, observe with and without walking aid if possible. IIAbnormal finding is a usually compensatory maneuver rather than a primary problem.

Figure 2. Tinetti Balance and Gait Tests

Table 1. Demographic characteristics of the study patients and their visual acuity levels before and after cataract surgery					
	Age (years)	Visual acuity (LogMAR)			
		Preoperative	Preoperative	p	Fellow eye
Female (n=27) (mean)	43-79 (66.59±10.02)	0.3-3.0 (1.31±0.80)	0.0-0.1 (0.27±0.04)	0.001	0.0-2.5 (0.48±0.67)
Male (n=24) (mean)	33-87 (67.38±13.53)	0.3-2.5 (1.33±0.71)	0.0-0.15 (0.01±0.03)	<0.001	0.0-1.9 (0.51±0.74)
Total (n=51) (mean)	33-87 (66.96±11.69)	0.3-3.0 (1.32±0.75)	0.0-0.15 (0.20±0.04)	<0.001	0.0-2.5 (0.48±0.69)

Table 2. Balance scores of the study patients before and after cataract surgery									
	Female			Male			Total		
	Preoperative	Preoperative	p	Preoperative	Preoperative	p	Preoperative	Preoperative	p
Berg Balance Scale (mean)	23-56 (48.67±8.69)	27-56 (50.78±8.43)	0.369	45-56 (52.75±3.44)	46-56 (53.88±2.95)	0.230	23-56 (50.59±7.00)	27-56 (52.24±6.59)	0.224
Tinetti Gait Test (mean)	5-12 (9.89±1.74)	7-12 (10.37±0.82)	0.009	8-12 (10.29±1.04)	10-12 (10.63±0.40)	0.043	5-12 (10.08±1.45)	7-12 (10.49±1.07)	0.001
Tinetti Balance Test (mean)	6-16 (14.11±3.17)	7-16 (14.78±2.64)	0.003	12-16 (15.21±1.38)	12-16 (15.58±1.02)	0.095	6-16 (14.63±2.53)	7-16 (15.16±2.06)	0.001
Tinetti total (mean)	11-28 (24.00±4.70)	14-28 (26.48±0.71)	0.072	20-28 (25.08±1.41)	22-28 (24.00±1.41)	0.101	11-28 (25.00±1.41)	17-28 (25.50±0.70)	0.020

Table 3. Changes in balance scores according to visual acuity before cataract surgery (Mean values are given in parentheses)			
	Visual acuity (Snellen)		
	≥0.05 (n=35)	<0.05 (n=16)	p
Age (years)	33-84 (66.91±11.35)	43-83 (67.06±12.78)	0.967
Increase in visual acuity (%)	97.17±5.66	99.38±1.41	0.036
Preoperative Berg Balance Test	23-56 (50.54±7.00)	28-56 (50.69±7.22)	0.946
Preoperative Berg Balance Test	27-56 (52.40±6.45)	29-56 (51.88±7.09)	0.795
Preoperative Tinetti Balance Test	6-16 (14.57±2.66)	8-16 (14.75±2.30)	0.818
Preoperative Tinetti Balance Test	7-16 (15.09±2.20)	9-16 (15.31±1.78)	0.720
Preoperative Tinetti Gait Test	5-12 (10.00±1.53)	7-12 (10.25±1.29)	0.574
Preoperative Tinetti Gait Test	7-12 (10.43±1.45)	9-12 (10.63±0.89)	0.547

This may indicate a stronger association between balance and vision in women.

Preoperative vision level also affects the benefit of cataract surgery on visual outcome.[18] When we compared our patients' results in two groups based on preoperative visual acuity level, the group with preoperative visual acuity worse than 0.05 showed a significantly larger increase in postoperative 1-month visual acuity than the other group (p=0.036). However, we detected no significant differences between these two groups in terms of increases in balance or gait scores. Although studies evaluating the effect of vision on balance and falls have yielded very different results, most authors agree that increased vision has a positive impact on the ability to maintain balance.[15,17,19,20] In contrast to these data, the authors of a study published in 2015 argued that visual impairment in elderly cataract patients was not associated with balance disorders or falls.[21] Furthermore, Cumming et al.[22] found that improving older adults' vision through treatment actually increased the incidence of falls, but they attributed this discrepant result to the fact that the patients became more mobile and active when their vision was restored. In their study of 413 patients over 50 years old, To et al.[17] observed a 78% reduction in risk of falls after surgery on the first eye and 83% after surgery of the second eye. Foss et al.[23] reported that the incidence of falls decreased by 32% after surgery on the second eye. Desapriya et al.[19] showed that early cataract surgery substantially improved visual acuity but had no significant effect on falls. However, Supuk et al.[24] emphasized that after cataract surgery, there was a significant decrease in vertigo rather than in the incidence of falls.

Most of the published studies on this topic have been retrospective, with patients' visual acuities analyzed after examining the patients' records or conducting surveys regarding their falls history.[4,14,15,16,17,24,25,27] Compared to objective tests, these surveys both provide inadequate information and may give rise to misleading data due to patients' inaccurate recollection of past events. Moreover, as visual acuity is measured at the time of the study, accurate information cannot be obtained about the patients' visual acuity at the time of falling. The scientific significance of our study lies in the fact that it was planned as a prospective study and the patients were tested and evaluated at the same time by an ophtalmologist and a physical therapist. Most previous studies focused on vision and falls incidence, but there are few studies that have tested and compared patients' pre- and postoperative balance.

Like many other studies, the current study demonstrates that, by referring individuals to eye examinations at regular intervals, quality of life can be increased and a substantial proportion of falls can be prevented in older adults.[3,14,15,17,20,28,29]

Study Limitations

One limitation of our study is that vision level varied in the patients' fellow eyes. While the fellow eye also had cataract in some patients, others had near perfect vision (mean LogMAR=0.48). This might have affected their balance scores. The visual benefit of cataract surgery might also vary depending on the status of the fellow eye.[18] Moreover, sudden increase in vision in one eye while the other eye still has cataract may cause imbalanced vision and consequently impaired balance rather than improved balance. In fact, Meuleners et al.[25] found that the incidence of falls requiring hospitalization doubled in the interval between first and second cataract surgeries compared with the preoperative period, and argued that ophthalmologists must warn patients to be more careful regarding falls after the first surgery.

Another limitation of the study is that we did not assess any other vision functions such as visual field, contrast sensitivity, depth perception, or color vision, factors that may also play a role in increasing the risk of falls. However, it is known that most of these parameters also improve after cataract surgery.[3,26] Therefore, we believe that the cataract surgery we performed corrected these parameters to some degree along with visual acuity.

Conclusion

This study demonstrates that phacoemulsification and intraocular lens implantation significantly increases visual acuity within the first postoperative month. As a result, the low functional balance scores of individuals with severe visual impairment increased significantly. This significant postoperative improvement in vision functions may contribute to better balance and enhance patients' quality of life.

Ethics

Ethics Committee Approval: Antalya Training and Research Hospital Clinical Research Ethics Committee, 2016-129.

Informed Consent: Received.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Fulya Duman, Zeynep Kılıç, Concept: Fulya Duman, Design: Fulya Duman, Data Collection or Processing: Fulya Duman, Zeynep Kılıç, Analysis or Interpretation: Fulya Duman, Emel Ece Özcan Ekşi, Literature Search: Fulya Duman, Writing: Fulya Duman.

Conflict of Interest: No conflict of interest was declared by the authors.

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