

# Difficulties of daily tasks in advanced glaucoma patients - a videotaped evaluation

## *Dificuldades no cotidiano dos pacientes com glaucoma avançado - avaliação objetiva com registro em vídeo*

---

Ana Isabel Martinho Miguel<sup>1</sup>, Cristina Fonseca<sup>2</sup>, Nuno Oliveira<sup>2</sup>, Filipe Henriques<sup>2</sup>, João Filipe Silva<sup>2</sup>

### ABSTRACT

**Objective:** The purpose of this study was to perform an objective videotaped evaluation of the difficulties of eyedrop instillation and daily tasks in patients with advanced glaucoma with visual impairment. **Methods:** A prospective observational study was performed in advanced glaucoma patients with visual impairment, during 5 months. Patients completed a survey (with demographic questions, quality of life, compliance and eyedrop instillation) with interview and video recording in specific daily tasks (eyedrop instillation, climbing stairs, walking in a crowded room and in an irregular floor). Ophthalmologic evaluation was performed and its results registered in a form. Correlation was searched between limitation in quality of life, tasks' performance and visual fields. **Results:** 25 patients were included, corresponding to 12h of videotaping. All patients reported being capable of self-instilling eyedrops. 68% of them reported no difficulty instilling the eye drops at home, however 20% of the patients were unable to instill a drop in the eye in the objective evaluation. 72% of the patients stated never touching the eye with the bottle but 40% touched the ocular surface with the bottle. There was a moderate difficulty in the other tasks, with some patients exhibiting proprioceptive mechanisms of adaptation to impaired vision. There was a tendency of correlation between limitation in tasks and visual field defects, but no statistically significant. **Conclusion:** Patients with advanced glaucoma and visual impairment have marked difficulty in eye drop instillation and daily tasks, with a poor awareness of their inabilities. Some patients have proprioceptive adaptations that allow them to perform better than expected in tasks.

**Keywords:** Glaucoma; Video recording; Quality of life; Patient compliance; Activity of daily living

---

<sup>1</sup> Polyclinique de la Baie, Avranches, França.

<sup>2</sup> Hospital and University Center of Coimbra, Portugal.

This work was partially presented at the 55th Portuguese Congress of Ophthalmology, December 6, 2012, in Lisbon.

**The authors declare no conflicts of interest**

Received for publication 08/08/2013 - Accepted for publication 24/11/2014

## RESUMO

**Objetivo:** O objetivo deste trabalho foi avaliar objetivamente, com registro em vídeo, as dificuldades dos pacientes com glaucoma avançado na colocação de colírios hipotensores e na realização de tarefas do cotidiano. **Métodos:** Realizou-se um estudo prospectivo observacional em pacientes com glaucoma avançado e perda visual. Os dados foram coletados durante 5 meses e posteriormente aplicados questionários (questões demográficas, qualidade de vida, autoadministração de colírios e aderência ao tratamento) e realizadas entrevistas e gravações das tarefas em vídeo (autoadministração dos colírios, leitura, subir e descer escadas, deambular em espaços apertados e pavimentos irregulares). Realizou-se avaliação oftalmológica com registro em formulário pré-definido e pesquisou-se a correlação entre os defeitos de campos visuais e as limitações dos pacientes. **Resultados:** Com 25 participantes foram obtidos um total 12 horas de vídeo. Todos os doentes afirmaram ser capaz de colocar os colírios hipotensores e 68% afirmaram nunca ter falhado na instilação do colírio. No entanto, 20% não conseguiram instilar uma única gota no olho. Setenta e dois por cento (72%) dos pacientes afirmaram nunca tocar o frasco no olho, porém 40% afirmaram tocar. Houve dificuldade moderada nas atividades, especialmente ao deambular em espaços com obstáculos e em pavimentos irregulares. Alguns pacientes apresentaram mecanismos proprioceptivos de adaptação à baixa visão (como tatear o degrau com o pé). Houve uma correlação entre a severidade dos defeitos de campo visual e maior limitação nas atividades. **Conclusão:** Os portadores de glaucoma avançado têm considerável dificuldade nas atividades da vida diária e na instilação de colírios, frequentemente com percepção deficiente. Alguns pacientes apresentam adaptações proprioceptivas para superar parte da limitação visual.

**Descritores:** Glaucoma; Gravação em vídeo; Qualidade de vida; Cooperação do paciente; Atividades cotidianas

## INTRODUCTION

It is estimated that glaucoma is the 2nd largest global cause of blindness<sup>1</sup>. In the case of a chronic disease whose treatment usually includes self-administration of hypotensive eyedrops, treatment adherence is essential to reduce the risk of progression of glaucomatous damage<sup>2</sup>.

Treatment adherence refers to all the aspects which distinguish the correct administration of treatment prescribed<sup>2,3</sup>, beyond the correct compliance with the use of medication by the patient and the appropriate persistence (continued treatment over time).

In glaucoma, non-adhesion to treatment is associated with the progression of glaucomatous damage<sup>4,5</sup>, leading to visual loss<sup>6</sup>. Studies estimate that adhesion occurs in 25 to 39% of patients with initial glaucoma<sup>2,7-9</sup>. But patients with advanced glaucoma, by noticing some visual impairment, are more motivated to therapeutic adhesion; however, these patients have greater difficulty in self-administering eyedrops<sup>10</sup>. Such difficulty may be responsible for involuntary non-adhesion and not perceived by the patient, as suggested in recent studies of the capacity of eye-drop administration in patients with advanced glaucoma<sup>11,12</sup>.

The correct placement of a droplet in the conjunctival fornix depends on several factors, such as the ability to see<sup>13</sup> and squeeze the bottle<sup>14</sup> or to detect whether the droplet has fallen in or out of the eye<sup>15</sup>. Only three studies used videotaping to objectively assess the difficulty of patients with advanced glaucoma in self-administering hypotensive eyedrops<sup>11,12,15</sup>.

Besides the difficulty in using eyedrops, the patients with advanced glaucoma reported greater difficulties in many daily tasks<sup>16,17</sup>. Thus, these patients have a lower quality of life than patients without glaucoma and patients with initial glaucoma<sup>18,19</sup>. Cowdin et al. confirmed that the visual field defects translate into negative impact on quality of life<sup>20-22</sup>, and that patients with advanced glaucoma are at a higher risk for falls<sup>23</sup>. However, there is no study objectively assessing with video recording the abilities and difficulties of patients to perform daily tasks.

The aim of our study was to assess objectively and with video recording the performance on specific daily tasks of patients with advanced glaucoma. The secondary objectives included estimating the quality of life of these patients identifying the relation between visual field defects and the limitation in performing daily activities and quality of life.

## METHODS

### *Study design*

We conducted a prospective unicentric observational study. The study lasted 5 months (from April 1 to August 31, 2012).

### *Selection of participants*

A systematic sample of the patients selected was obtained in a glaucoma consultation during the study period at the Hospital and University Center of Coimbra, Portugal, sector of Ophthalmology, subspecialty Glaucoma. The first three patients of each consultation day that met the inclusion criteria were invited to take part in the study. The study was explained to the patients, who filled a written and oral informed consent. The inclusion criteria in the study were:

- Primary open angle glaucoma (POAG) diagnosis by tonometry, gonioscopy, assessment of the optical disc and visual field
- Diagnosis made by the ophthalmologist at least in the consultation prior to the consultation to select the participant
- Participant's age  $\geq$  18 years old
- Experience in self-administration of hypotensive eyedrops for at least 6 months
- Visual acuity (VA)  $\geq$  20/60 or moderate to severe campimetric defect in at least one eye<sup>11</sup>

The exclusion criteria were:

- Other types of glaucoma
- Suspected glaucoma
- VA  $\leq$  perception of hand bilateral movements
- Disagreement in taking part in the study
- Patients with dementia, psychiatric or neurological pathologies impeditive from answering the questions

- Patients who claimed to be unable to self-administer the eyedrops
- Patients with other eye diseases responsible for visual loss.

#### Data collection methods

A questionnaire was applied and interviews were held by nurses and secretaries (after prior training) with various demographic, social, treatment adherence and quality of life questions (using the validated instrument *Glaucoma Quality of Life 15*, GQL15). Each patient had a complete ophthalmologic examination with recordings in a previously created form: eye and surgical history, ophthalmic medication in use, VA, biomicroscopy, Goldmann applanation tonometry, funduscopy including assessment of the optic disc, gonioscopy, results of visual field exams and optical coherence tomography (OCT).

#### Quality of life assessment - GQL 15

The GQL15 (*Glaucoma Quality of Life 15*) is a validated instrument for measuring the quality of life that includes 15 questions that can be aggregated into a single summary measure through the sum of the values of answers to the 15 variables. The higher the value in this scale, the lower the quality of life applied to vision. The questionnaire assesses difficulties in:

- Reading newspapers or magazines
- Walking in the dark
- Seeing at night
- Walking in floor with differences in level
- Adapting to an environment with intense lighting
- Adapting to an environment with poor lighting
- Going from a lighted room to a dark one or vice versa
- Avoiding tripping over objects
- Seeing objects approaching from the side
- Crossing the street
- Going up or down the stairs
- Walking without bumping into objects
- Estimating the distance from the foot to a step
- Finding fallen objects
- Recognizing faces

#### Video recording

The recording of each task was performed by the author AM, who did not witness the results of the questionnaire and ophthalmologic evaluation to avoid bias. The duration planned for the recording was 5 minutes per task.

#### 1. Self-administration of eyedrops

To assess the performance in the self-administration of hypotensive eyedrops, we asked the patients to put one droplet in each eye, using their hypotensive eyedrops (if the patient had not brought it, we offered a bottle). We do not use artificial tears (unlike the study held by Hennessy et al.<sup>11</sup> in order to create most of the conditions of normal use of the patient. We recorded all patient attempts, but evaluated the 1st so that the results would not get crossed with the patient's training. Each patient was allowed to use their usual technique to put on eyedrops, whether it involved the use of a mirror, a reclining chair or even a stretcher for the administration in supine position. The following variables were registered: successfully putting on at least one droplet in the eye (defined as "partial success", and the respective time in seconds) successfully putting on only a droplet in the eye without touching the ocular surface (defined as the "complete success" and the respective time in seconds) number of attempts until success, number of drops administered.

#### 2. Reading

An updated correction was prescribed to the patients for close vision and a scale for close vision and a magazine were provided. The reading capability at about 40 cm distant was recorded on video.

For the tasks described below the patients who had major motor and mobility difficulties were excluded.

#### 3. Walking around in spaces with obstacles

Only one room was used and the obstacles were prepared the same way: the room had an area of 6m<sup>2</sup> and the patients were asked to follow a pathway of 2m lined with obstacles so that the free area of the pathway was only 50cm long. Thus, it was possible to detect how the visual defects interfered in the ability to identify side obstacles (some located on the floor and others 70 cm tall).

The following outcome variables were recorded (after the video recording): number of touches or bumps into the obstacles, number of proprioceptive aid (such as the use of hands or elbows to feel the obstacles instead of seeing them) and overall rating of the difficulty to complete of the task.

#### 4. Walking on uneven flooring

Patients were sent to a specific inpatient ward, where they were invited to walk 5m of uneven flooring and climb a poorly visually marked step. This task was video recorded, as well as the classification of difficulty of each patient in performing it.

#### 5. Climbing stairs

The patients were asked to climb 8 steps of a stair in which edges were not visually marked. It was recorded in video, the overall performance was classified and the proprioceptive aid was identified.

#### 6. Going down the stairs

The procedure was the same as in the previous task, with the evaluation of the difficulties to go down the stairs.

#### Statistical analysis

We used the program SPSS version 20 for the statistical analysis. In the continuous variables of normal distribution we used the *t-test* to identify the differences between two groups; in the non-normal distribution we used the Mann-Whitney test. In categorical variables with normal distribution we used the chi-square test, and in the non-normal distribution we used the Kruskal Wallis test. The multivariate logistic regression models were built to predict factors of difficulty and the success in each of the tasks. The significance considered was 0.05.

## RESULTS

#### Characterization of the population

In this study, interviews and objective evaluation were performed with videos of 25 patients, with a duration of total recording of approximately 12 hours. The mean age of participants was 73 years old. Nine participants (36%) were female; 68% were retired (Table 1).

The 25 participants said they have been using the hypotensive eyedrops for more than 6 months and instill the eyedrops by themselves. Twenty-four patients (96%) reported to follow the glaucoma treatment correctly. Fifty-five percent of

the patients (55%) reported having difficulties in instilling eyedrops, and 30% reported occasionally not being able to instill eyedrops by themselves, needing help. Seventeen patients (68%) reported never having failed to instill even a droplet of eyedrops, and 18 patients (72%) said they had never touched the ocular surface with the bottle (Table 2).

**Table 1**

**Socio-demographic characteristics of the participants**

Characteristics	Number or mean	% or standard deviation (sd)
Female	9	36%
Age (mean)	73 years	sd: 9.11
Caucasian	25	100%
Education	35% without education 65% with primary education only	
Systemic diseases	40% systemic arterial hypertension 15% osteoarticular pathology 20% diabetics 20% smoker /ex-smoker 35% hyphoacuisis 20% cardiovascular pathology 25% pulmonary pathology	

**Table 2**

**Examples of participants' responses to the questionnaire**

Characteristics	Percentage and number	Standard deviation (sd)
Self-assessment of vision*	46.1%	sd: 22.2
Self-assessment of treatment adhesion**	96.8%	sd: 11.3
Patients who reported never had difficulties in putting eyedrops	17 (68%)	
Patients who reported never touched the eye with the bottle	18 (72%)	

\* Response to "Rate your vision from 0% to 100%, with 0% being total blindness and 100% normal vision. \* Response to the question: "Rate your treatment adhesion from 0% to 100%, with 0% being having never put a droplet and 100% having never failed or forgotten to put any droplets of the treatment"

**Ophthalmologic assessment**

The mean VA of the patients was 1.03 logMAR (equivalent to 1/10 in decimal notation). The mean tonometry was 13 mmHg, the excavation of the optic disc in average 8/10 (there were some patients with a total excavation and VA for unilateral light perception). The mean deviation of all visual fields was -22dB (severe campimetric loss). Patients were treated with an average

of 2 bottles hipotensorese eyedrops, and 92% had undergone glaucoma surgery.

**Self administration of eyedrops and adhesion to treatment**

Forty percent of the patients managed to put a droplet of eyedrops in the eye with an appropriate technique. Twenty percent of the patients were unable to self-administer even a droplet, even after several attempts. Patients placed on average 2.45 droplets in the eye (one patient put 7 droplets), and it took them on average 10.4 seconds to put the droplet in the eye (the maximum was 38 seconds). Seven patients (28%) were unable to detect whether the droplet entered eye: 1 patient put the droplet in the eye but did not detect it and instilled 2 more droplets; the other 6 patients put the droplet out of the eye and finished the task for thinking that they had put the droplet correctly. (Table 3)

Table 3 describes the assessment results with video of the patients self-administering the eyedrops.

**Table 3**

**Summary of the objective assessment with video of patients self-administering the eyedrops**

Self-administration of the eyedrops	Mean or %
Partial success (≥ 1droplet in the eye)	80%
Partial success time	10.4 segundos
Total success (put just one droplet into the conjunctival fornix without touching the ocular surface)	40%
Total success time	10.5 segundos
Number of attempts before success	1.65
Number of droplets put in the eye	2.45
Patients who touched the ocular surface with the bottle	40%

**Objective reading assessment**

18 patients (70%) had little or no difficulty.

**Objective assessment of daily activities**

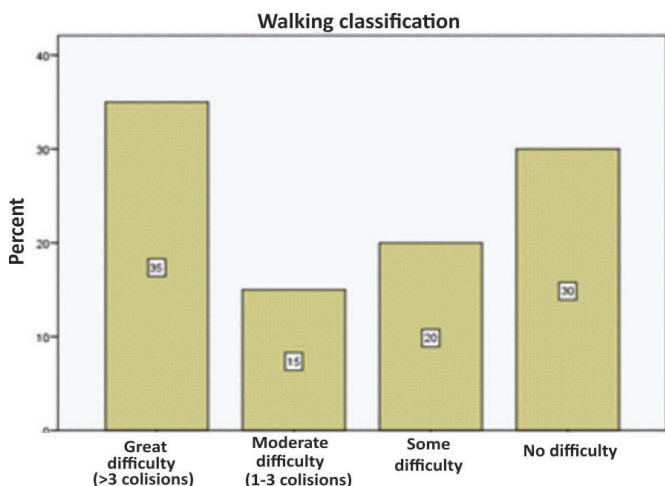
Five patients (20%) were excluded from the assessment of these activities for presenting important locomotor difficulties, in order to avoid selection bias.

Regarding the performance of the patients to go up and down the stairs, 8 participants showed proprioceptive adjustment mechanisms like using their foot to feel the position of the step before supporting their weight on the step or touching the handrail to go up or down the stairs. Three of the patients had marked difficulties to go up and/or down the stairs.

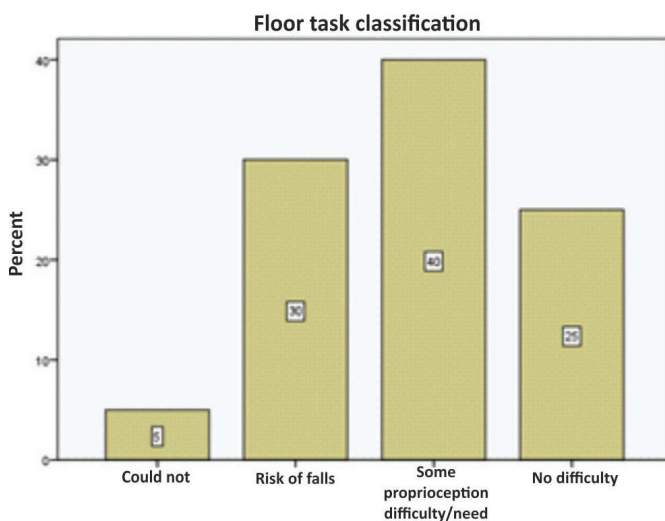
We did not have enough sample of patients to complete logistic regression models and predict the factors for success or failure in putting eyedrops or performing motor tasks that were statistically significant, but there was a trend to failure in patients with greater visual field defects and worse visual acuity, and a trend to success in daily activities in patients who had proprioceptive adaptation mechanisms which allowed them to partially compensate for their low visual function.



There was a trend to correlate a worse quality of life in each of the GQL 15 questions to a greater visual field defect (mean deviation), being it statistically significant only for the issue of difficulties to see at night (Pearson's correlation,  $p = 0.042$ ).



**Figure 1.** Objective rating of the ability to walk in a room with several side obstacles



**Figure 2.** Difficulties of the patients with advanced glaucoma to walk on an uneven floor

## DISCUSSION

After a literature review with several databases (*PubMed, Scopus, Cochrane Central, Ovid, and Google Scholar*), we noted that the current study was the 4th one to objectively assess with video self-administration of hypotensive eyedrops in advanced glaucoma, and the only one to objectively assess the performance of various daily tasks<sup>10-12</sup>.

The objective assessment with video recording of various daily tasks allowed to characterize the performance and difficulties of the patients with advanced glaucoma, which information can help to improve the quality of life of these patients.

In this study we observed that the patients did not realize their visual impairments: they did not estimate their vision correctly, did not realize their difficulties in administering eyedrops and in walking.

The concern for the self-administration of eyedrops is relatively new and important, since the wrong operation is responsible for non-adhesion to treatment, which can lead to the progression of glaucomatous damage. Our results are similar to previous studies<sup>12</sup>, but the Portuguese patients seem to have poorer perception of their limitations: 68% of the patients in our study denied failure to instill the eyedrops, but 20% failed to put at least one droplet, while in the American study<sup>11</sup> 36% of the patients stated that and 35% failed to instill.

From the 72% of Portuguese patients (and 69% of Americans) who said they never touched the eye with the bottle, only 40% did not touch (versus 24% of Americans). We should warn patients about the potential risk of contamination of the bottles when they touch the ocular surface<sup>24</sup> and risk of ocular injuries<sup>25</sup>. Subjective observational studies estimated that patients failed by 50% in putting eyedrops (the droplet fell out of the eye)<sup>26,27</sup>.

Seven patients (28%) did not notice if the droplet was instilled into or out of the eye. One of the patients instilled the droplet into the eye but did not realize it and put several other drops, causing an increase to the cost of the treatment<sup>28</sup>. And the other 6 patients put the droplet out of the eye and thought it was instilled in it, generating concerns of therapeutic poor compliance and the possibility of progression of an already advanced disease<sup>6,15</sup>.

It is important that the ophthalmologist check the instillation technique of hypotensive eyedrops in the patients with glaucoma, to guide them regarding the proper handling of the medication, as signaled in the Brazilian study<sup>29</sup> which showed that only 2.5% of new cases of glaucoma presented occlusion of the lacrimal point after instillation, and that 23.3% with glaucoma recurrence instilled the eyedrops with the eye closed, drawing attention to the problem of correctly instilling the eyedrops. Patients should be supervised or a chaperone can instill the eyedrops to the patient in order to increase the chance to instill of droplet in the eye.

In the present study, the poor perception of the patients regarding their limitations was widespread, occurring in predicting the ability to perform tasks such as walking on uneven surfaces, and also in the self-assessment of VA, where the mean self-assessment of VA was 0.46 whereas the mean VA measured by the ophthalmologist was 0.1.

Performing tasks like walking in spaces with obstacles and uneven surfaces was very difficult and had some "near-falls", which justifies the increased fear of falls among patients with glaucoma<sup>21</sup> and the reduced quality of life proved in this and other studies<sup>17</sup>. It would be interesting to train patients with advanced glaucoma regarding orientation and mobility to prevent accidents and improve the quality of life. In this study, several patients had conscious or unconscious adaptive proprioception mechanisms that allowed them a better performance than expected for their visual function. It would be helpful to teach these simple mechanisms to all patients with advanced glaucoma to increase their quality of life. Some of these mechanisms include: touching the step with the foot to identify it, touching the handrail (before going up or down the stairs and on uneven floors),

walking with the arms bent and protruding elbow (in tight spaces, to identify side obstacles), touching or stretching the arms in tight spaces (not to collide with little visible obstacles).

Although the results were interesting, it was complex and time consuming to have this full assessment in each patient, which had limited the size of our sample. It would be useful to develop protocols with video technicians, as the ones developed in other studies<sup>11,12</sup> instead of having the ophthalmologist tape the patients. And also to develop protocols along with other hospitals, even in national level, in order to have a multicentric study identifying peculiarities in different patient populations and increasing the capacity for possible construction of logistic regression models.

The performance of daily tasks is also a challenge for patients with low visual function by other eye diseases, so it is interesting to expand the objective assessment of tasks for these patients, as done in the study comparing glaucoma to retinal pathology<sup>12</sup> in the self-administration of eyedrops, with poor performance being found in both groups.

## CONCLUSION

Patients with advanced glaucoma have a marked difficulty in daily activities, often with poor perception of their limitations. There was a correlation between the severity of the visual field defects and a higher limitation in the activities.

Many patients failed to self-administer the hypotensive eyedrops and did not detect said failure.

Some patients presented proprioceptive adaptations to overcome part of the visually impairment in locomotor daily tasks.

## THANKS

To the secretary (Paula Ramos) and nurses of the Ophthalmology consultation for the effort during the interviews and questionnaires. to the technicians of the Ophthalmology consultation for their support during this work.

## SUPPLEMENTARY MATERIAL

Some videos will be available in a protected internet page as a complementary part of this work for consultation by health professionals, provided that users comply with the principles of ethics and the Declaration of Helsinki in: <http://www.eyerobot.pt/glaucoma.php>

## REFERENCES

- Kingman S. Glaucoma is second leading cause of blindness globally. *Bull World Health Organ.* 2004;82(11):887-8.
- Schwartz G, Quigley H. Adherence and persistence with glaucoma therapy. *Surv Ophthalmol.* 2008;53 Suppl1:S57-68.
- American Academy of Ophthalmology. Glaucoma. Section 10 in AAO's Basic and Clinical Science Course; 2008; 10: 5-35.
- Urquhart J, Vrijens B. New findings about patient adherence to prescribed drug dosing regimens: an introduction to pharmionics. *Eur J Hosp Pharm Sci.* 2005;11(5):103- 6.
- Vrijens B, Vincze G, Kristanto P, Urquhart J, Burnier M. Adherence to prescribed anti-hypertensive drug treatments: longitudinal study of electronically compiled dosing histories. *Br J Ophthalmol.* 2008;336(7653):1114 -7.
- Stewart WC, Chorak RP, Hunt HH, Sethuraman G. Factors associated with visual loss in patients with advanced glaucomatous changes in the optic nerve head. *Am J Ophthalmol.* 1993; 116(2):176-81.
- Reardon G, Schwartz GF, Mozaffari E. Patient persistency with topical ocular hypotensive therapy in a managed care population. *Am J Ophthalmol.*2004; 137(1 Suppl):S3-12.
- Schwartz GF, Platt R, Reardon G, Mychaskiw MA. Accounting for restart rates in evaluating persistence with ocular hypotensives. *Ophthalmology.* 2007; 114(4):648-52.
- Ashburn FS Jr, Goldberg I, Kass MA. Compliance with ocular therapy. *Surv Ophthalmol.* 1980;24(4):23-48.
- Nordstrom BL, Friedman DS, Mozaffari E, Quigley HA, Walker AM. Persistence and adherence with topical glaucoma therapy. *Am J Ophthalmol.* 2005;140(4):598-606.
- Hennessy AL, Katz J, Covert D, Protzko C, Robin AL. Video-taped evaluation of eyedrop instillation in glaucoma patients with visual impairment or moderate to severe visual field loss. *Ophthalmology.* 2010;117(12):2345-52.
- Hennessy AL, Katz J, Covert D, Kelly CA, Suan EP, Speicher MA, et al. A video study of drop instillation in both glaucoma and retina patients with visual impairment. *Am J Ophthalmol.* 2011;152(6): 982-8.
- Winfield AJ, Jessiman D, Williams A, Esakowitz L. A study of the causes of non-compliance by patients prescribed eyedrops. *Br J Ophthalmol.*1990;74(8):477- 80.
- Brown MM, Brown GC, Spaeth GL. Improper topical self-administration of ocular medication among patients with glaucoma. *Can J Ophthalmol* 1984;19(1):2-5.
- Stone JL, Robin AL, Novack GD, Covert DW, Cagle GD. An objective evaluation of eyedrop instillation in patients with glaucoma. *Arch Ophthalmol.* 2009;127(6):732-6.
- Miguel A, Silva JF, Azevedo L, Henriques F, Andr es R, Lopes N, Rito F, Loureiro AR. Qualidade de vida no glaucoma. *Oftalmologia.* 2012; 36(1Supl): 33-40.
- Varma R, Wu J, Chong K, Azen SP, Hays RD; Los Angeles Latino Eye Study Group. Impact of severity and bilaterality of visual impairment on health-related quality of life. *Ophthalmology.* 2006;113(10):1846-53.
- Patino CM, Varma R, Azen SP, Conti DV, Nichol MB, McKean-Cowdin R; Los Angeles Latino Eye Study Group. The impact of change in visual field on health-related quality of life: the los angeles latino eye study. *Ophthalmology.* 2011;118(7):1310-7.
- Wilson MR, Coleman AL, Yu F, Bing EG, Sasaki IF, Berlin K, et al. Functional status and well-being in patients with glaucoma as measured by the Medical Outcomes Study Short Form-36 questionnaire. *Ophthalmology.* 1998; 105(11):2112- 6.
- Cowdin RM, Wang Y, Wu J, Azen SP, Varma R. Impact of Visual Field Loss on Health-Related Quality of Life in Glaucoma: The Los Angeles Latino Eye Study. *Ophthalmology.* 2008;115(6): 941-948e.1.
- Hodapp E, Parrish RK II, Anderson DR. Clinical decisions in glaucoma. St. Louis: Mosby; 1993. p.59.
- Nelson P, Aspinall P, Papanouliotis O, Worton B, O'Brien C. Quality of life in glaucoma and its relationship with visual function. *J Glaucoma* 2002;12(2):139-50.
- Ramulu PY, vanLandingham SW, Massof RW, Chan ES, Ferrucci L, Friedman DS. Fear of falling and visual field loss from glaucoma. *Ophthalmology.* 2012;119(7):1352-8.
- Schein OD, Hibberd PL, Starck T, Baker AS, Kenyon KR. Microbial contamination of in-use ocular medications. *Arch Ophthalmol.* 1992; 110(1):82-5.

25. Geyer O, Bottone EJ, Podos SM, Schumer RA, Asbell PA. Microbial contamination of medications used to treat glaucoma. *Br J Ophthalmol.* 1995;79(4):376-9.
26. Burns E, Mulley GP. Practical problems with eye-drops among elderly ophthalmology outpatients. *Age Ageing.* 1992; 21(3):168-70.
27. Konstas AG, Maskaleris G, Gratsonidis S, Sardelli C. Compliance and viewpoint of glaucoma patients in Greece. *Eye (Lond).* 2000;14Pt 5:752- 6.
28. Gottlieb JL. Helping low-income patients obtain prescription medications. *Arch Ophthalmol.* 2002;120(11):1575-6.
29. Costa VP, Vasconcellos JPC, Pelegrino M, Kara-José N. Análise da técnica de instilação de colírios por pacientes glaucomatosos / Analysis of the technique of instillation of drops by glaucoma patients. *Rev Bras Oftalmol.* 1995; 54(7):523-8.

---

**Corresponding author:**

Ana Isabel Martinho Miguel  
E-mail: myworld\_ana@hotmail.com