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Research Article

DYSPHOTOPSIA AFTER CATARACT SURGERY

Fouad Chraibi, Hassan Moutei, Ahmed Bennis, Meriem Abdellaoui and Idriss Andaloussi Benatiya

University Hospital Hassan II and faculty of Medicine and Pharmacy of Fez,
University Sidi Mohamed Ben Abdellah, Fez, Morocco

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A B S T R A C T

Dysphotopsia after cataract surgery is an undesirable optical phenomena experienced subjectively by the patient. There are positive dysphotopsia (PD) and negative dysphotopsia (ND). In PD, the patient perceives halos, flashes, and streaks; while in ND he perceives a fixed temporal peripheral shadowing. we investigate occurrence of this complication in our daily practice by systematically searching for subjective signs of dysphotopsia among 500 patients operated for uneventful cataract surgery. We found 5 cases of dysphotopsias among 500 patients operated for uneventful cataract surgery, they all were managed conservatively with resolution of symptoms. we discuss physiopathology and available treatment approaches ranging from observation, and non-surgical treatments which include conservative, pharmacological myosis, optical correction, ocular surface problems treatment, and ocular occlusion to surgical treatments which include: Yag laser capsulotomy, inverted capsular capture, intraocular lens (IOL) exchange, piggyback IOL placement, IOL nasal edge truncation, and IOL rotation. Cataract surgery is becoming a mainstream surgery from which the patient expect full satisfaction. dysphotopsia can be source of frustration both for the patient and the surgeon. A perfect knowledge of this complication will allow to improve management and prevention of this particular source of post-operative complaints.

INTRODUCTION

Dysphotopsia after cataract surgery is an undesirable optical phenomena experienced subjectively by the patient. It occurs in the aftermath of an otherwise perfectly conducted and trouble-free cataract surgery. We distinguish positive dysphotopsia (PD) and negative dysphotopsia (ND). In PD, the patient perceives halos, flashes, and streaks; while in ND he perceives a fixed temporal peripheral shadowing.Impact of dysphotopsia on quality of life is huge; it is reported as being the most important cause of dissatisfaction of patientsin a perfectly conducted cataract surgery (1,2).

MATERIAL AND METHODS

In this article, we report the experience of our department (University Hospital Hassan II, department of ophthalmology, Fez, Morocco) in diagnosing and managing cases of dysphotopsia after cataract surgery.It is a prospective study that took place from February 2018 to April 2018 in our department. We investigated actively signs of dysphotopsia at 1 month postoperatively in 500 patients who had uncomplicated phacoemulsification surgery. For patients who present with signs of dysphotopsia, we specify the age, gender, types of perceived dysphotopsia (PD or ND), we perform the temporal illumination test and the temporal barrier test that can reduce symptoms of ND, we assess visual acuity, refraction in spherical equivalent (SE), we perform examination of the anterior segment with a close observation of the edge of capsulorhexis location and transparency, the intra-ocular lens (IOL) centration and transparency, then we perform fundus and the peripheral retinal examination, and finally by reviewing the charts of patients we precise the type of the used IOL.

Corresponding author:* **Fouad Chraibi
University Hospital Hassan II and faculty of Medicine and Pharmacy of Fez, University Sidi Mohamed Ben Abdellah, Fez, Morocco

RESULTATS

Among the 500 patients concerned, we found 5 cases of dysphotopsia: 2 ND and 3 PD. A brief synopsis of these 5 cases is provided in the following sections.

Case 1: was a patient aged of 53 years-old, he complains of glare and halos , his non corrected visual acuity (VA) was 10/10 and spherical equivalent (SE) of -0.5D - patient operated for mature cataract-, eye examination found a large capsulorhexis of around 8 mm diameter , the IOL was made of silicon, the course was spontaneously resolutive.

Case 2: she was a female patient aged of 47 years old, she reports ND. only lateral illumination improved the symptoms ;

her non corrected VA was 8/10, and corrected VA was 10/10 (SE= -1.25D), her examination found in particular a small

Table 1 clinical features of our dysphotopsia cases

	Age	Gender	Type	Clinical signs	Temporal illumination test	Temporal barriere test	Visual acuity	Refraction (SE) in D	BCVA	Physical examination	IOL	Treatment	Course
case 1	53	Male	positive	glare halos	N.A.	N.A.	10/10	-0.5D	10/10	A large capsulorhexis = 8 mm	silicon	observation	spontaneously resolutive
case 2	47	female	negative	temporal shadow	+	-	8/10	-1.25D	10/10	Small size pupill mesopic 3mm	acrylic	optical correction	good
case 3	55	male	negative	temporal shadow	+	+	7/10	-0.75	8/10	Temprally displaced capsulorhexis	acrylic	optical correction	good Capsular opacification
case 4	50	male	positive	streaks Glare	N.A.	N.A.	10/10	-0.25	10	No particular finding	acrylic	observation	spontaneously resolutive
case 5	58	female	positive	streaks Halo	N.A.	N.A.	8/10	-0.5	9/10	No particular finding	acrylic	observation	spontaneously resolutive

N.A : not applicable
\+ : the test relieves symptoms
\- : the test doesn't relieve symptoms

mesopic pupil of 3mm , she had been implanted by an acrylic IOL. She was given optical correction; and symptoms improved after 2 months concomitant with an opacification of the anterior capsulorhexis.

Case 3: a male patient aged of 55 years old , presented with ND , both Temporal illumination test and Temporal barrier tests improved symptoms , his uncorrected VA was 7/10 and corrected VA 8/10 (SE = -0.75), his examination found a nasally displaced capsulorhexis, and his IOL was an acrylic one, he was given optical correction, and the symptoms improved within 3 months.

Case 4: was a 50 year old male patient, complains of PD made of streaks and glare, his uncorrected VA was 10/10, and eye examination was unremarkable, his IOL was acrylic, and follow up showed spontaneous improvement over a course of two weeks.

Case 5: was a female patient aged of 58 years old , she reports PD made of streaks and halos, and her corrected VA was 9/10, eye examination was unremarkable , she was observed for 1 months and the course was also spontaneously favorable.

DISCUSSION

In our series, the prevalence was 0.4% for ND and 0.6% PD after 1 month postoperatively. While in the literature this prevalence has been very variable according to the series, the postoperative duration and the type of the used IOL. For ND , the prevalence varies from 0.5% to 25% the first week after surgery and from 0.9% to 9.4% one or two months after surgery (3). For PD, the prevalence can reach up to 49% of cases (4) if we include the first signs that occur the first weeks after cataract surgery and which are transient. On the other hand, the methodology used to investigate dysphotopsias appears to influence estimation of its prevalence; according to a study by Makhotkina et al, the prevalence was estimated to be 8% if the symptoms are reported spontaneously by patients, while it increases to 18% if symptoms are looked for actively by the investigator (5).

ND is characterized by a fixed dark shadow on the temporal side of vision, often described by patients as "if they wear blinders on their sides".

ND results from the oblique incident light on the pseudophakic eye creating a "gap" between the light refracted by the nasal edge of the optics of the IOL and the light not refracted by this

same edge. The shadow intensity may decreases with temporal illumination or if a lateral diaphragm (6) is placed in place.To study ND; Holladay *et al* (7) have shown by ray-tracing techniques that the maximum angle of refraction of light by the

IOL is 85.7º whereas the minimum angle of light refraction is 88.3º, leaving a 2.6º shadow space. Other factors according to the same authors are: a wide kappa angle, an equi-biconvex or plano-convex IOL, a short axial distance between the iris and IOL, and an anterior capsule that overhangs the IOL optics on the nasal side, the quadrangular edge of the implant, and the pupil of small size.

In a study by Bournas *et al* (8) comparing 4 types of implants: hydrogel implant, a silicone implant, and 2 acrylic implants of two different diameters, the authors showed that acrylic implants are more likely to induce Negative dysphotopsias and in this same class of acrylic implants, the smaller the diameter of optics; the greater is the risk of ND.

The opacification of the nasal capsule has been reported as a protective factor. they advocate that an opacified nasal capsule will allow a randomly scattered light and thus diminishing the chances of occurrence of ND, but some authors have shown that even capsular opacification doesn't prevent occurrence of negative dysphotopsias in all cases and may even require Yag laser capsulotomy (9).

PD are characterized clinically by perception of luminous streaks, light arcs, and flashes that are caused by oblique light, and an important internal reflexivity of the IOL. The risk factors for PD are acrylic implants (because of their high refractive index), quadrangular edge implants, small diameter implants less than 5 mm (10), implants with small radius of anterior curvature , and a broad capsulorhexis not covering the edge of the optic risk (11).

ND is more likely to persist, while PD is more likely to be a transient phenomenon.

Treatment strategy of this condition encompasses different approaches. the first level is communication skills with the patient, then there are non-surgical and surgical approaches as appropriate function of the type of dysphotopsia.

Patients' complaints must always be validated and reassured by the fact that many of these symptoms will tend to disappear spontaneously. Some authors reassure patients about ND by telling them that the perceived temporal shadow corresponds to the edge of the optic nerve (12) at least in the first weeks while waiting for spontaneous resolution.

The first line of treatment is the non-surgical approach which includes conservative, pharmacological myosis, optical correction, ocular surface problems treatment, and ocular occlusion.

The surgical approach may include: Yag laser capsulotomy, inverted capsular capture, IOL exchange, piggyback IOL placement, IOL nasal edge truncation, and IOL rotation.

Observation is indicated initially for PD and ND, many cases will tend to evolve favorably; this was the approach we adopted for all our patients with spontaneous resolution of symptoms in all cases.

Pharmacological myosis is indicated for PD only; this treatment should not be used as a definitive solution but just as a temporary relief while waiting for the improvement of the signs.

Optical correction is indicated in both types of dysphotopsias, the correction of even a minimal refractive vice can improve the condition of the patient (12).

The treatment of a possible ocular surface problem in both types of dysphotopsias is always recommended.

Ocular occlusion is recommended by some authors as a therapeutic method in ND (12); it's not known whether ocular occlusion helps treat ND itself or just alleviate symptoms while waiting for spontaneous improvement.

For surgical approaches, we point out that the main part of literature deals with ND, while there is very few articles about management of PD.

Yag laser capsulotomy is reported by many authors as beneficial in the treatment of ND in cases where the anterior capsule is transparent. That said, treatment with Yag laser capsulotomy is not always effective, Folden *et al* (13) report 6 cases of ND treated by anterior Yag laser capsulotomy with symptoms resolution in only 3 out of 6 cases (50%). The nasal edge of the capsulorhexis being moderately opaque is not fully protective against ND ; Cooke *et al* (14) report the case of a patient with ND despite a moderately opaque nasal capsule which was treated by Yag laser directed for ablation of the nasal capsule with resolution of ND symptoms.

Several authors report the interest of inverted capsular capture which consists of the placement of the nasal and temporal margins behind the edge of the optics of the IOL. Masket *et al* (15) report 3 cases of resolution of ND with this technique.

Implant exchange: Burke *et al* (16) report 5 eyes with ND (having the following IOLs: 3 Tecnis ZCBOO, and 1 Acrysof SN60WF, and 1 Akreos Adapt AO) treated with implant exchange and placement of a 3-piece implant (Acrysof MA60AC) in the sulcus with resolution of symptoms; and preventively in 1 case with placement of an implant in the sulcus in the fellowpreventing occurrence of ND post-operatively.

Taubenslag *et al* (17) report the resolution of ND in seven out of ten patients after exchange with an in the bag IOL with broad and ovoid optic.

In an article published by Vámosi *et al* (18) 3 cases of exchanges, including an IOL placed in the bag and 2 cases of exchange with an implant placed in the sulcus, the course was marked by the disappearance of the ND in the last two cases and its persistence in the first case which may point out be the role of decreasing the distance between the implant and the iris in reducing the occurrence of ND.

Piggyback implantation is advocated by many authors; in an article by Makhotkina *et al* (19) ; the authors report the experience of 9 eyes having ND treated by placement of a Sulcoflex IOL in the sulcus, with resolution of signs in 6 eyes. the success of this technique can be explained by the fact that the edge of the second piggyback implant is rather round.

Erie *et al* (20) using the techniques of Ray-tracing suppose the mechanisms of action of this therapeutic model (e.g: piggyback IOL) being an increase in distance between the iris and the primary implant from 0.46 mm preoperatively to 0.75 mm postoperatively , and by reducing the minimal angle of the incident ray from which the scotoma begins increasing from 84° to 76° allowing light dispersion which decreases ND incidence. However in the same article, the symptoms disappeared only in 2 patients out of 3.

Zeldovich *et al* (21) report a case of ND treated by a toric sulcoflex IOLby piggybacking the initial IOL with resolution of ND.

Piggyback implantation is not a risk-free surgery, indeed; Pupillary block, pigmentary glaucoma, cystoid macular edema, IOL decentration, and uveitis-glaucoma-hyphema syndrome are all potential complications.

Alpati *et al* (22) propose to truncate the nasal edge of the implant to eliminate the participation of the nasal capsule in the genesis of ND. the authors state that creating a rather irregular edge of the optic allows light scattering on the nasal side with reduced shadowing. the authors report the experience of a single clinical case of ND treated by nasal edge truncation of the optic by partly displacing the optic of the IOL in the anterior chamber and cutting the nasal edge of the optic with adapted scissors.

For PD (23); surgical treatments includeIOL exchange with placement of an IOL of less refractive index, horizontal IOL rotation or piggyback implantation in the same way ND are being treated.

Prophylactic measures to prevent dysphotopsia is of paramount importance; particularly in the setting of a patient who presented this issue in the first operated eye. Narang *et al* (24) report their experience in preventing dysphotopsia by placing a tension ring in the bag and practicing inverted capsular capture of the IOL in 6 eyes of patients who had ND initially in the eyes already operated by phacoemulsification. Prophylactic treatment prevented ND in all six cases. the

tension ring prevents proliferation of peripheral epithelial cells, retraction and fibrosis of the capsular bag. According to Henderson *et al* (25) the positioning of the acrylic IOL in the infero-temporal position allows the reduction of 2.3 times the incidence of ND than if the IOL is positioned vertically. by orienting the IOL obliquely in infero-temporal position; light scattered by haptics will prevent formation of ND.

Softec HDO (Lenstec Inc); an IOL with oval optic was designed to prevent ND ; but Masket *et al* (26) report 2 cases with intolerable PD requiring implant exchange.

CONCLUSION

Cataract surgery is becoming a mainstream surgery from which the patient expect full satisfaction.

occurrence of dysphotopsia ; which by the way happens in a perfectly conducted surgery, can be a source of frustration both for the patient and the surgeon. A perfect knowledge of this complication will allow to improve management and prevention of this particular source of post-operative complaints.

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