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Incidence of dysphotopsia following uneventful cataract surgery [phacoemulsification] in patients implanted with different types of monofocal intraocular lenses

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Abstract

Background and objectives: Pseudophakic dysphotopsia is one of the major causes of patient dissatisfaction after cataract surgery. Our aim was to assess the incidence of dysphotopsia after phacoemulsification with implantation of three types of monofocal intraocular lenses.

Methods: This prospective clinical study which contained 200 eyes from 195 patients was done at Dr. Aso eye hospital in Sulaimania city between June 2022 to June 2023. Those 200 eyes (participants) were divided into three different groups according to their IOL types were followed-up for 6 months to estimate the incidence and symptoms of dysphotopsia.

Results: overall incidence of dysphotopsia was (22%). 34 cases (17%) reported their symptoms in the first three weeks of follow-up. This figure decreased to (4% and 1%) after 3 and 6 months, respectively. The most common phenomenon noted was temporal shadow/darkness; declared by 34.09% of patients who reported dysphotopsia. Optical phenomena occurred more frequently in patients with Acryfold lens group. The great majority of the patients (94.5%) were satisfied with their post-operative visual function. Both, overall incidence of dysphotopsia and its higher rate in the 1st group (Acryfold) were statistically significant values (p= 0.0399 and 0.0418), respectively. Conversely, there was no statistically significant difference between Rayner and Acrysof lenses in terms of dysphotopsia occurrence (p-value= 0.053).

Conclusion: Although monofocal intraocular lenses showed significant rates of dysphotopsia, they were still associated with high patient satisfaction level because majority of the symptoms were mild and went away with time.

Keywords: Cataract, Dysphotopsia, Intraocular lens, Phacoemulsification, Posterior Capsular Opacification.

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Introduction

The main purposes in phacoemulsification are improving sight and protecting the retina against harmful rays. It is usually terminated by implanting a foldable posterior chamber intraocular lens. With all the progressions in the intraocular lens designs, which has enhanced visual outcomes, patients may still complain of optical side effects known as dysphotopsia. The term dysphotopsia was manipulated by Tester et al.[1] in the beginnings of the 2000s to refer to several light-related optical phenomena that were experienced by phakic and pseudophakic patients. However, photic phenomena following intraocular lens implantation was first reported by Arnold.[2] Symptoms related to pseudophakic dysphotopsia were subdivided into positive and negative ones. Negative dysphotopsia is discerned as a dark temporal shadow, line or crescent, whilst positive phenomenon is primarily presence of flashes, halos, glare, light streaks or starbursts around vision's central axis, particularly during scotopic situations when pupil is larger.[3] The origin of this problem is not fully understood and is frequently alleged as multifactorial. Factors pertaining to the intraocular lens type and design are currently the matter of the discussion. Positive dysphotopsia is caused by illuminated artifacts of light on retina. Osher assumes that the symptoms of negative dysphotopsia occurring right after phacoemulsification and disappear several days later might be associated with resolution of edema of the clear corneal incisions.[4] Even though dysphotopsia was initially described in eyes implanted with high refractive-index hydrophobic acrylic lenses, they are now being reported with 3-piece silicone and hydrophilic acrylic lenses, too. Those symptoms can often be elicited by the shape and diameter of the optic, with higher incidence in sharp-edged optic designs.[5] However, sharp-edge square optic reduces chances of posterior capsular opacification (PCO) late after cataract surgery.[6] A good clarification about the negative phenomenon is interaction between optical axis of the eye and that of the IOL. The proposed mechanism is production of a gap between the light rays that are refracted by the IOL optic and those which miss the optic and hit some part of the retina periphery. Both IOL design (notably truncated edges) and patient factors (high IOL power and smaller pupil) can share the issue. A deeper anterior chamber has been thought of increasing the likelihood rates of the negative symptoms.[1,7] Hydrophilic acrylic lenses have a more plentiful water composition than hydrophobic ones, which lead to a higher incidence of posterior capsular opacification but a lower concurrence of dysphotopsia.[8] The prevalence of severe negative dysphotopsia changes but is relatively small. Davison reported an incidence of 0.2% in a big number of participants implanted with truncated acrylic intraocular lenses.[3] Osher announced 15.2% on the first postoperative day, which declined to 2.4% after two years.[4] The majority of the photic symptoms are transient and fade away with time due to neuro-adaptation. For persistent symptoms refractive error correction, treating dry eye symptoms, and use of thick framed glasses have been suggested. A percentage of around 2% who may suffer intense chronic symptoms, might be given with a surgical option. Laser anterior capsulotomy (YAG), reverse optic capture, removal of the nasal overlapping fibrotic capsule, sulcus insertion of a round secondary IOL by the piggyback technique, and finally, for those with unresolving debilitating symptoms, intraocular lens exchange with all its risks and complications should be a matter of argument with the patient.[2-4,9,10] The aim of our work is to estimate the incidence of dysphotopsia associated with the type of the IOL implanted, and to examine whether our patients were satisfied with their post-operative visual function or not.

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Patients and methods

This prospective cohort study (questionnaire-based) has contained 200 eyes of 195 patients who had uneventful phacoemulsification with intraocular lens implantation, from June 2022 to June 2023 executed at Dr. Aso Eye Hospital, Sulaymaniyah, Iraq. The patients were given full information about the purpose and steps of the study and written informed consent was produced from them rightfully. Research ethic's approval was obtained from Kurdistan Higher Council of Medical Specialties' ethical committee. The surgeries were accomplished by several surgeons, in the same operating room, using similar equipment and phacoemulsification techniques. They were performed under local anesthesia by using retrobulbar block. Oertli's Faros device 2012 was used to emulsify the cataracts. The eyes were implanted with a posterior chamber monofocal acrylic IOL at the end. Preoperative data for every patient including age, gender, ophthalmic history, visual acuity, slit-lamp exam, refraction, and intra-ocular pressure was recorded. Participants were categorized into three groups based on the IOL type implanted. Group1: Acryfold® (601) [Appasamy, acrylic, 6 mm optic, single-piece (1P), biconvex, square-edge allover, refraction index (RI): 1.460]. Group 2: C-flex® Aspheric (970C) [Rayner, acrylic, 5.75 mm optic, 1P, 360° enhanced square-edge, RI: 1.460]. Group3: AcrySof® MA60AC [Alcon, acrylic, 6 mm optic, 3P, asymmetric-biconvex, RI: 1.550]. Groups 1 and 2 are hydrophilic lenses while the third is a hydrophobic lens. The IOLs are all monofocal. Once each eye, postoperatively, cleared totally and a pure uneventful phacoemulsification was documented, follow up and questioning for the detection of optical phenomena began on 3 weeks, 3 and 6 month-interval bases. The inclusion criteria applied to each eye postoperatively were: an uneventful phacoemulsification with a clear cornea, round reacting pupil, deep and silent anterior chamber, and an IOL centered in the capsular bag. No marked visual field defect, macular pathology, glaucomatous optic neuropathy, vitreous opacity, amblyopia, significant postoperative inflammation, refractive errors >1.0 DS/DC or unexplained low visual acuity. Participants with significant cognitive impairment or mental health issue were excluded. After all those measures, 200 eyes were selected and finalized in the study. This study was organized to assess dysphotopsia symptoms after phacoemulsification from the perspective of multiple subjective questions. All the eye had detailed slit-lamp examination at 3 weeks, 3 and 6 months-interval period. After that, patients were asked to answer questions attributed to a questionnaire based on previous studies.[1,11] They were asked about the quality of their vision, looking for the specific photic symptoms that might bother them. Those who complained of optical events were asked about the nature and severity of the symptoms, the way it could possibly affect their vision and daily activities, and lastly whether they were satisfied with their new vision or not. Patients who did not complain of dysphotopsia symptoms were not interviewed again. At the third survey visit (6th month), they were carefully examined for the development of any visually significant posterior capsular opacification (PCO) which might interfere with the results of the study. Statistical analysis accomplished using statistical package for social sciences software (SPSS 29-0). Contingency tables were used to present frequency distributions where appropriate. Continuous data was managed through quantitative descriptive measures. Analysis of variance was done to check for age and groups homogeneity. Confidence intervals were calculated at the level of 95%. Statistical significance was set at 95% (p value <0.05). Microsoft office excel 2016 used for data tabulation.

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Results

This study involved 200 participants, 105 (52.5%) were males, and 95 (47.5%) were females. The age range of the patients was (30-75) years, and the mean age was (62.10) years, as shown in Table (1).

Table (1): Frequency distribution of participants by gender and mean age of presentation.

	Frequency	Percent			Age
Male	105	52.5	N	Valid	200
Female	95	47.5		Missing	0
Total	200	100	Mean		62.1

These groups were checked for homogeneity of age and gender. No significant statistical differences were found. Incidence of dysphotopsia was 22% (44 cases) overall, with a markedly higher rate for the positive versus negative symptoms (65.90% vs. 34.09%), Table (2).

Table (2): Incidence of dysphotopsia.

		Frequency	Percent
Valid	Absent	156	78.0
	Present	44	22.0
	Total	200	100.0

During the first follow-up survey (3rd week), 34 participants (17%) complained of dysphotopsia. However, this figure declined to 4% and 1% at 3 and 6 months, respectively. Incidence of dysphotopsia and its nature over the specified period has been summarized in Table (3).

Table (3): Nature of dysphotopsia symptoms by IOL type over specified period.

Period		IOL Type	Temporal Shadow	Central Flash	Night Glare	Light Arc	Halos	Starburst	Total
3rd week	IOL Type	Acryfold	6	3	4	2	3	0	18
		Rayner	3	3	1	2	1	3	13
		Acrysof	0	0	1	1	1	0	3
	Total		9	6	6	5	5	3	34
3rd Month	IOL Type	Acryfold	3			1	1	0	5
		Rayner	2			0	0	1	3
	Total		5			1	1	1	8
6th month	IOL Type	Acryfold	1					1	2
	Total		1					1	2
Total	IOL Type	Acryfold	10	3	4	3	4	1	25
		Rayner	5	3	1	2	1	4	16
		Acrysof	0	0	1	1	1	0	3
	Total		15	6	6	6	6	5	44

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A total of 185 hydrophilic and 15 hydrophobic IOLs were implanted. Patients with Acryfold 6.0 mm IOL reported dysphotopsia more frequently (23.14%) than the rest of the participants, with the most common phenomenon being temporal shadow/darkness. This finding was statistically significant (p = 0.049). The percentage was 20.77% and 20.0% for Rayner and Acrysof lenses respectively, as has been highlighted in Figure (1).

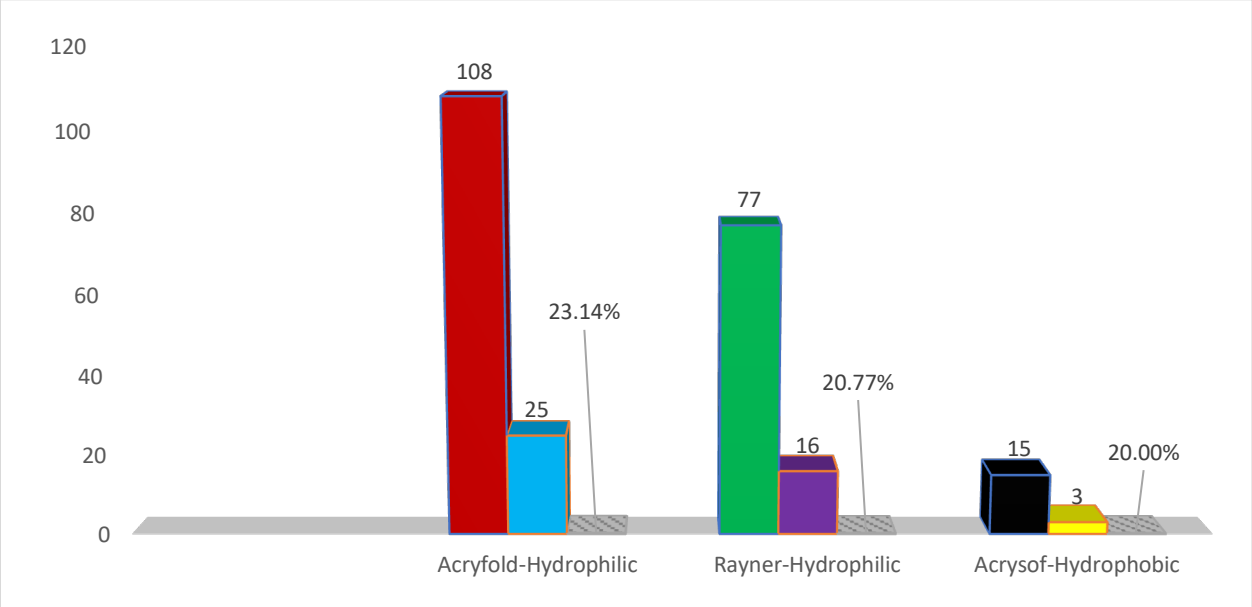

Figure (1): Dysphotopsia rates/IOL group.

In our study, 189 patients (94.5%) were satisfied with their postoperative vision, Figure (2). The symptoms were massively mild (93.18%), while 6.18% showed moderate to severe phenomenon. No any participant complained of debilitating optical problems at all.

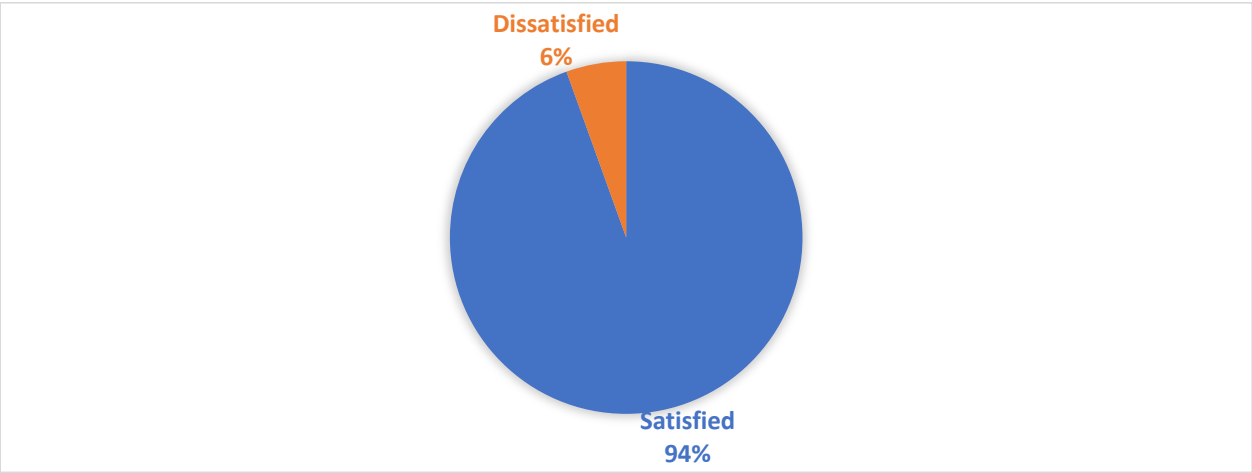

Figure (2): Post-operative visual satisfaction.

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Discussion

Dysphotopsia is a notable and important optical complaint which may happen after uneventful phacoemulsification with intraocular lens implantation in the capsular bag. Despite changes in the IOL models design, pseudo-phakic dysphotopsia is one of the utmost origins of patient dissatisfaction following cataract surgery, and correlates greatly with visual function and quality.[12,13] The link of this phenomenon with the IOL design has been established in the scientific papers. Bournas and colleagues[14] reported that optic phenomena occurred more frequently in patients implanted with square-edge AcrySof lenses than did with the AMO Clariflex, which is round anterior and square on its posterior surface.[14] Holladay took down the primary risk factors from a paper he composed which included a smaller photopic pupil, larger positive angle-kappa, size of the IOL, shorter axial distance between the iris and the IOL, and a non-horizontal optic-haptic junction of the lens.[7,15] Secondary risk factors involved edge design of the IOL, its material, and negative aspheric surfaces. Incidence of pseudo-phakic dysphotopsia has varied through the literature, but it flows somewhere between 2-18%, with a higher rate for multifocal lenses as an increased visual demand. Some sources report that intense dysphotopsia was declared by only 0.2% of the patients.[3] In a paper by Davison photic events occurred in 1% of the cases. Our outcomes almost comply with the data reported in literature.[16] In our study, percentage of cases reported dysphotopsia ranged from 17% in the first visit to 1% after 6 months (3rd visit). The great majority showed mild non-disturbing symptoms. We confirm that the phenomena decreased slowly over time since the incidence of dysphotopsia progressively and largely lessens with time. This trend looked the same for all the IOL groups. Although there were three cases with moderate to severe symptoms who did not require any intervention, we could not identify any troublesome or debilitating phenomenon at all. In fact, the nature of these optical events will be finally modified by the development of posterior capsular opacification or higher cortical adaptation.[17] Dysphotopsia has actually been described with all IOL types, with a more frequent report in acrylic truncated edge lenses.[1] However, it has been found in silicone square-edge IOLs, too.[18] Round-edge silicone and polymethylmethacrylate as well as non-reflective square-edge acrylic lenses seemed less likely to induce clinically important photic phenomena.[3] Despite the fact review that the edge-design of the IOL shares a marked place in the occurrence of dysphotopsia, we could not clearly establish this in our study. It will probably be accounted for by the disparity in our sample sizes among different IOL groups and the answers shared by the participants in response to our questionnaire. In our work, we found that the incidence of dysphotopsia among the three IOL groups was roughly the same, with a slightly higher rate in the Acryfold lens type. Although this is a hydrophilic acrylic lens having a 6.0 mm optic and a square-edge allover, it overtook the counterpart C-flex Rayner with a 5.75 mm optic and a 360° enhanced square-edge in terms of dysphotopsia occurrence. This finding will justify that the IOL's optic size is not a main deciding factor in the incidence of optical events as was also found in a study by Arnold.[2] More than half of all photic symptoms materialized in the Acryfold group lens implants. On the other side, incidence of glare and halos was quite little in patients with either C-flex or AcrySof lens insertions due to absence of surface glistening in the

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former and a higher index of refraction (RI) in the latter. The above finding gives an impression about the role of the lens material and its RI in the development and nature of the related dysphotopsia. While Acryfold's larger 6.0 mm optic produced more optical events than its hydrophilic counterpart, Rayner with 5.75 mm optic (both are square-edge allover) goes against literature review, we still think that the 360° enhanced edge factor in the latter has caused this lens to lag behind its predecessor. Arysof MA60AC hydrophobic implants with 6.0 mm optic size showed the same dysphotopsia rates as the Rayner group with absence of any negative phenomenon. The only reason that makes this lens manifests only positive symptoms is its relatively higher RI compared to the hydrophilic IOLs (1.550 vs. 1.460).[19,20] A notably lower incidence of negative dysphotopsia in contrast to the positive type (34.09% vs. 65.90%) in the hydrophilic intraocular lenses can be interpreted by the fact that the surgeons placed most of the IOL haptics horizontally or inferior-temporally (intentionally for the study purpose), and this has been already found to be a favorable reason for the reduction of ND occurrence.[21-23] What is worth-mentioning in our study is that, 94.5% of the patients were satisfied with their fresh postoperative visual function. This outcome will be best explained by their huge visual improvement after phacoemulsification in comparison to their low vision prior to surgery. Lastly, the vast experience of the surgeons (surgeon factor) in performing outstanding phacoemulsification techniques such as perfect corneal incisions, optimal and precise capsulorhexis size to fulfil optic capture, proper IOL centration in the capsular bag, posterior capsular polishing in case of any significant fibrosis or opacity on it, and full viscoelastic washing at the end of the surgery have surely had a positive impact on our highly successful surgical results and absence of any visually significant posterior capsular opacification in the long-term follow up period.

Conclusion

Despite great modifications in intraocular lens designs and surgical techniques, photic events still appear to be vexing visual concerns after cataract surgery. Monofocal IOLs are a good choice for low demand patients undergoing phacoemulsification. Although they are associated with significant rates of dysphotopsia, they have high post-operative patient satisfaction levels as well. The reason is that most of the symptoms are mild non-disturbing and tend to fade away with time. They very seldom require intervention.

Conflict of interest:

None to declare.

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