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High Rate of Early Posterior Capsule Opacification following Femtosecond Laser-Assisted Cataract Surgery

Benjamin Rostami^a Jack Tian^a Nicholas Jackson^b Rustum Karanjia^{a, c, d}
Kenneth Lu^{a, c}

^aDoheny Eye Center, Department of Ophthalmology, David Geffen School of Medicine at UCLA, Los Angeles, Calif., USA; ^bDivision of General Internal Medicine and Health Services Research, Department of Medicine Statistics Core, David Geffen School of Medicine at UCLA, Los Angeles, Calif., USA; ^cDoheny Eye Institute, Los Angeles, Calif., USA; ^dOttawa Eye Institute, University of Ottawa, Ottawa, Ont., Canada

Keywords

Cataract · Posterior capsule opacification · Femtosecond laser-assisted cataract surgery

Abstract

Purpose: To compare the rates of rapid posterior capsule opacification (PCO) formation in the first 3 months following femtosecond laser-assisted cataract surgery (FLACS) to manual anterior capsulorhexis. **Methods:** Retrospective review of 29 cases of FLACS, comparing the rates of PCO in the first 3 months following surgery to 50 consecutive cases of manual anterior capsulorhexis. **Results:** Seven of the 29 FLACS cases developed PCO requiring capsulotomy at 3 months, while none of the control cases required a capsulotomy over the same time period ($p < 0.05$). **Conclusion:** There is an increased incidence of early-onset PCO following the use of femtosecond laser in cataract surgery that is otherwise unfounded in man-

ual capsulorhexis. This suggests that the use of a femtosecond laser could increase the risk of this novel postoperative complication.

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Introduction

Femtosecond laser-assisted cataract surgery (FLACS) is a relatively recent evolution of traditional manual phacoemulsification cataract surgery. The laser can be used to perform the capsulotomy, lens fragmentation, and corneal incision, which results in enhanced precision, decreased phacoemulsification power, and improved centration of the intraocular lens (IOL) [1, 2]. This, in turn, should result in better vision and long-term outcomes [3]. Posterior capsule opacification (PCO) is a recognized complication of cataract surgery [4]. Though common, PCO usually presents several months to years after cataract surgery. In this study, we sought to report and investigate the incidence of rapid PCO formation in the first 3 months following the use of FLACS. Furthermore, we examined the efficacy of anterior capsule polishing in reducing the rate of early-onset PCO formation in FLACS.

Methods

A retrospective chart review was completed of 29 consecutive cases of FLACS (capsulotomy and laser fragmentation) and 50 consecutive cases of cataract surgery with manual anterior capsulorhexis and standard phacofragmentation (control), which were performed over the same time period by the same surgeon at the Doheny Eye Center, UCLA. The same LENSAR cataract laser was used for all FLACS cases with the same parameters for 5.0-mm capsulotomy and lens fragmentation. All patients had the AMO Z9002 3-piece Tecnis IOL. The two groups were compared in terms of the incidence of rapidly forming, visually significant PCOs that required Nd:YAG laser capsulotomy within 3 months of the initial cataract surgery. Further, the FLACS cases were divided based on the use of anterior capsule polishing in the surgery protocol and compared to evaluate the efficacy of this technique in reducing the rate of PCO formation. Analysis was done with Fisher's exact test, and conducted in Stat version 13 (StataCorp LP, College Station, Tex., USA).

Results

The study evaluated 79 eyes from 63 patients. The mean age was 72.3 ± 10.9 years in the control group, and 72.6 ± 5.5 years in the FLACS group. The groups had similar male-to-female ratios, and overall, there were no significant differences in the demographics between the control and experimental groups (table 1).

There were no cases of PCO recorded within the first 3 months in any of the 50 control cases of cataract surgery with manual anterior capsulorhexis and standard phacofragmentation. In contrast, seven of the 29 FLACS cases developed PCO requiring capsulotomy over the same time period ($p < 0.05$). Anterior capsule polishing was not found to make a significant

difference in the rate of PCO formation ($n = 12$ FLACS without polish; 17 FLACS with polish; $p = 0.769$) (table 2, table 3). Additionally, it was noted in the procedural notes from Nd:YAG capsulotomy that the PCOs were of a fibrotic type that was difficult to laser.

Discussion

In this study, we sought to investigate the incidence of a unique new postoperative complication of FLACS, namely the rapid formation of fibrotic PCO in the first 3 months following the procedure. We found a statistically significant difference in the rate of this type of PCO when comparing cases of FLACS to manual anterior capsulorhexis and standard phaco-fragmentation.

Our small retrospective series suggests that the frequency and nature of PCO may be different and worth noting in FLACS. Despite previous studies that demonstrated the laser's relatively safe use, many experienced surgeons remain apprehensive to the adoption of the laser into their protocol, expressing concerns of a learning curve and possible unforeseen complications associated with the laser [5, 6]. In this series, we describe one of those unanticipated outcomes.

PCO was traditionally known to be a natural consequence of cataract surgery, the so-called 'secondary cataract' or 'after-cataract' that forms as displaced epithelial cells migrate posteriorly, make their way behind the IOL, and take residence on the posterior capsule [4]. As such, one proposal for the mitigation of rapidly forming PCO as a result of FLACS is anterior capsule polishing. However, the efficacy of this additional step in the procedure did not affect the rates of PCO in the FLACS group, and is still debated in the literature [7]. While polishing the anterior capsule is not a universally accepted way to delay the formation of PCO, in our situation, due to the alarming rate of early PCO formation, the surgeon decided to add this otherwise easy, straightforward step to try to address the issue at hand. Our small sample did not show a statistically significant lower rate of PCO with anterior capsule polishing, which could be because anterior lens epithelial cells might not be the ones responsible for the formation of the PCO.

The etiology of this reported phenomenon could stem from the previously described 'learning curve' [5, 6]. While all surgeons experience a learning curve when adapting their surgical technique to including new technology like FLACS, the rates in the control group by the same surgeon demonstrate the surgeon's skill and experience of having performed over 6,000 cataract surgeries. Additionally, in our study, the incidence of PCO was evenly distributed throughout rather than heavily concentrated towards the beginning of the time frame, which would have been more indicative of the presence of said learning curve. However, investigation as to the presence of a learning curve would require further long-term observation of PCO formation, which we hope to do and present at a later time. Alternatively, rapid PCO formation may be a result of thermomechanical damage to the lens epithelial cells, as the effects of thermomechanical damage to other ocular membranes have previously been described [2]. Of note, there was no association between PCO formation and the presence of other underlying chronic medical illnesses such as diabetes mellitus which could cause ocular damage. Four of the patients in our cohort were noted to have diabetes, none of whom were among those who had rapid PCO formation.

The high rate of PCO formation within 3 months suggests that there is a fundamental difference between the PCO formed in FLACS, which was also evidenced by the fibrous nature of the PCO, which required higher Nd:YAG energy levels to disrupt. Understanding the differences accounting for this increased fibrotic nature of the PCO could lead to improved techniques to mitigate the formation of PCO post-FLACS.

In the future, we would like to continue to investigate the observed phenomenon using a more robust prospective controlled trial. Furthermore, it might be worthwhile to compare the incidence of such outcomes amongst the various lasers that are on the market, which was difficult to do so at the small center where our pilot study was based. Since this study was conducted, we have already begun to collect data on two other lasers and hope to be able to present our findings at a later time, once we have a better sense of how the different devices on the US market compare both with respect to rapid PCO formation, as well as other phenomena such as intraoperative miosis.

Statement of Ethics

Informed consent was obtained. Institutional Review Board approval was obtained and the study protocol was approved by the institute's committee on research and was seen to meet institutional standards.

Disclosure Statement

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Table 1. Demographics by group

	Control	FLACS with polishing	FLACS without polishing
Average age, years	72.3±10.9	74.0±6.8	71.1±5.1
% Male	63%	50%	57%
% Female	37%	50%	43%

Table 2. Incidence of PCO and Nd:YAG capsulotomy at 3 months following surgery

Group	Sample size, n	PCO	Proportion	Nd:YAG capsulotomy	Proportion
Manual anterior capsulorhexis (control)	50	0	0%	0	0%
FLACS with polishing	17	3	18%	2	12%
FLACS without polishing	12	4	33%	3	25%

Table 3. Comparison of groups

Outcome	FLACS vs. control	FLACS + polish vs. control	FLACS vs. FLACS + polish
PCO	p = 0.016	p = 0.041	p = 0.769
Nd:YAG capsulotomy	p = 0.029	p = 0.180	p = 0.657