Femtosecond laser assisted cataract surgery: experience in glaucoma patients.

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Abstract

Purpose: To assess the changes of intraocular pressure (IOP) after femtosecond laser assisted cataract surgery (FLACS) in glaucomatous eyes and their postoperative evolution.

Materials and methods: Patients with glaucoma, who required cataract or combined cataract and filtering surgery, were included. All patients underwent a complete ophthalmologic assessment and visual fields (VF). FLACS alone or combined with a filtering surgery was performed. IOP was measured during surgery before and after docking with Schiotz tonometer. Changes from baseline in visual acuity (VA), IOP, and number of medications were evaluated.

Results: 27 patients were included in this study, 19 women and 8 men. Mean patient age was 70 (± 9.7 SD) years. 12 patients with primary open angle glaucoma, 13 with angle closure glaucoma and 2 with pseudoexfoliation glaucoma. 21 patients underwent FLACS alone and 6 combined with filtering surgery. There were no significant differences between pre docking (17.59 mmHg ± 6.25 SD) and post docking (17.23 mmHg ± 7.74 SD) IOP (P=0.7). No complications were recorded during the surgery or in the follow up term. Postoperative follow up revealed no changes from baseline VF mean deviation (p=0.47 and p=0.93), the mean IOP improved (p=0.0032), and the number of medications required decreased (p=0.0001).

Conclusion: FLACS is well tolerated in glaucomatous eyes and can be a safe tool for glaucoma patients undergoing cataract surgery alone or combined with filtering surgery. Similar results to traditional surgery can be obtained with the advantages of femtosecond laser precision.

Clinical Significance: Patients with glaucoma must be considered a separate group because of the added complexities that a lot of them can present. Safety and efficacy of FLACS has not been properly studied in the glaucoma population, which could be potentially benefited by the optimization of cataract extraction with the precision of laser technology.

Keywords: FLACS, Cataract Surgery, Femtosecond, Glaucoma.

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Introduction

Glaucoma is the leading cause of irreversible blindness worldwide. Today many medical and surgical treatments are available; nevertheless, filtration surgery has become the first choice of treatment for patients with glaucoma with severe damage or that show progression despite medical treatment [1].

A high percentage of these patients have preexisting cataracts or develop them over time, and glaucoma medications and filtering procedures are known to be cataractogenic, so a large number of glaucoma patients will require cataract extraction, filtering surgery, or a combined procedure over time [2].

The first Femtosecond Laser Assisted Cataract Surgery (FLACS) was performed in 2008, [3] and since its introduction its use has become widespread as a safe tool with benefits such as decreasing loss of endothelial cells, less post-operative nflammation, a well-centered and predictable capsulorrhexis, better intraocular lens (IOL) position, and less phacoemulsification energy and time requirements, among others [4-6].

The use of FLACS in glaucoma is an encouraging prospect, but very few studies on the safety of this technology on glaucoma patients are available. Glaucoma patients can have several characteristics that make cataract surgery more challenging: ocular surface disease, presence of filtering blebs, narrower anterior chambers, fragile zonules, small or poorly dilating pupils, and unpredictable behavior of the anterior capsule, among others, are issues that may present in several cases.

Another aspect of these patients is that many of them will require a filtering surgery at some point, which adds to the complexity of cataract surgery, either alone or in combination.

The equivalence or superiority of FLACS compared to manual phacoemulsification that justifies the use of this relatively new and expensive technology, cannot be determined with the available evidence available today [7].

Considering the characteristics of patients with glaucoma, and the risks that could be introduced to cataract surgery using Femtosecond pretreatment with the additional step of suction docking, we find it is important to assess the outcomes of FLACS in patients with glaucoma.

In the present study, we evaluated the changes of intraocular pressure (IOP) during and after femtosecond laser assisted cataract surgery either alone or combined with filtering surgery in glaucomatous eyes and their postoperative evolution.

Patients and Methods

A prospective case series study was conducted in a tertiary care ophthalmology center. The study was approved by the Institutional Review Board of the hospital, and followed the guidelines of the Declaration of Helsinki.

Patients who required cataract surgery alone or in combination with a filtering procedure were consecutively recruited. Inclusion criteria included diagnosis of open or closed-angle glaucoma, vision impairing cataract (Visual Acuity (VA)<20/40), progression of glaucoma despite maximal medical therapy, and intolerance to topical glaucoma medications.

Patients with history of ocular surgery, conjunctival alterations, VA<finger count, patients that could not comply with follow up, or that refused to sign an informed consent were excluded from the study.

Eligible patients underwent a comprehensive ophthalmological examination. Intraocular pressure was taken preoperatively and postoperatively in every visit with Goldmann applanation tonometer. Preoperative glaucoma medications used were registered and classified by class, based in the Terminology and Guidelines for Glaucoma 2nd Edition, Table IX, Monotherapy.

Patients performed Humphrey 24-2 white-on-white visual fields (VF), using the SITA-Standard algorithm with a size III stimulus; Mean Deviation (MD) was recorded preoperatively, and at 30 and 90 days postoperatively. Changes from baseline in VF were confirmed in at least two consecutive tests. VA was assessed using the ETDRS chart preoperatively and in every follow up visit on days 1, 3, 7, 30 and 90.

Femtosecond laser (LenSx Laser System, Alcon Laboratories, Inc.) anterior capsulotomy and lens fragmentation were completed in all patients. All cataract extractions, alone or in combination with a filtering procedure were performed by a single experienced surgeon (R.C.D.). Patients that underwent a combined procedure with glaucoma drainage (GDD) device had An S2 Ahmed Valve implanted in the upper temporal quadrant, with a scleral tunnel technique to introduce and protect the tube 4 mm from the limbus; the GDD was implanted after the cataract extraction and IOL implantation was completed.

Patients that underwent a combined procedure with trabeculectomy, had a fornix base conjunctival flap and limbal base scleral flap. The conjunctival dissection and scleral flap were performed before the cataract extraction without entering the anterior chamber, after the IOL implantation the trabeculectomy was completed.

IOP was recorded during surgery using a Schiötz indentation tonometer immediately before and after docking, prior administration of a topical anesthetic (tetracaine 0.5 g) with the patient in a supine position.

Data regarding BCVA, IOP, and VF were collected preoperatively and during the follow up using a computarized database (Microsoft Excel). The statistical analysis was made with GraphPad Prism 6 (GraphPad Software, Inc.). To compare continuous variables with a normal distribution, a T student test was used. To analyze data regarding IOP an ANOVA analysis and a post-hoc Bonferroni analysis were used. The normality of variables was considered using a Kolmogorov-Smirnov test. A $p<0.05$ was considered statistically significant.

Results

Twenty-seven eyes of 27 patients were included, 19 women and 8 men. Mean patient age was 70 (± 9.7) years. The diagnoses included 12 patients (44.4%) with primary open angle glaucoma, 13 with angle closure glaucoma and 2 with pseudoexfoliation glaucoma. Twenty-one patients underwent FLACS alone and 6 combined with filtering surgery: 2 (7.4%) with Ahmed Valve implantation, and 4 (14.8%) with trabeculectomy. No complications were recorded during any surgery.

Mean IOPs before (17.59 ± 6.25 mmHg) and after docking (17.23 ± 7.74 mmHg) showed no statistically significant difference (p=0.7) (Figure 1).

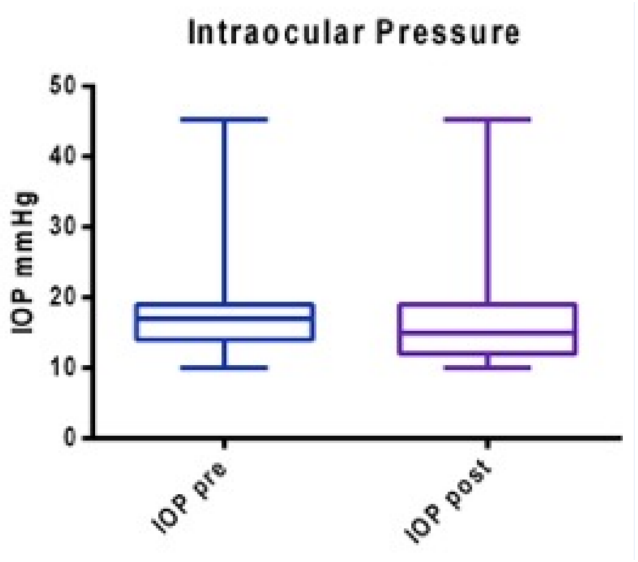

Figure 1. Preoperative and Postoperative Intraocular Pressure.

Mean baseline VA and best corrected VA (BCVA) were 0.67 logMar (± 0.39) and 0.40 logMar (± 0.36) respectively; at 90 days after surgery, mean VA and BCVA were 0.45 logMar (± 0.29) and 0.24 logMar (± 0.29) (p=0.03 and p=0.005) (Figures 2 and 3).

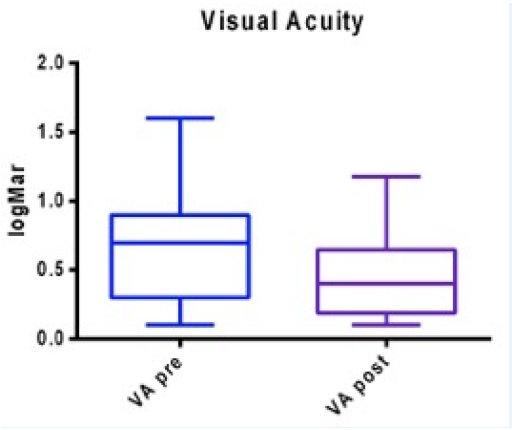

Figure 2. Preoperative and Postoperative Visual Acuity.

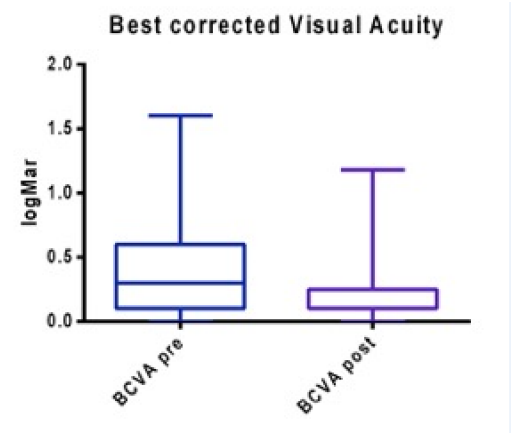

Figure 3. Preoperative and Postoperative Best Corrected Visual Acuity.

Patients who underwent FLACS with IOL implantation (n=21) showed a preoperative mean IOP of 15.48 mmHg (± 2.63), and in post-operative days 1, 7, 30 and 90 mean IOPs were 17.71 mmHg (± 5.64), 13.86 mmHg (± 2.70), 13.86 mmHg (± 2.03), and 14.29 mmHg (± 2.49) respectively. No statistically significant differences were found between preoperative IOP and IOP during follow up; the only significant difference was between postoperative day 1 and days 7, 30 and 90 (ANOVA p=0.0032) (Figure 4).

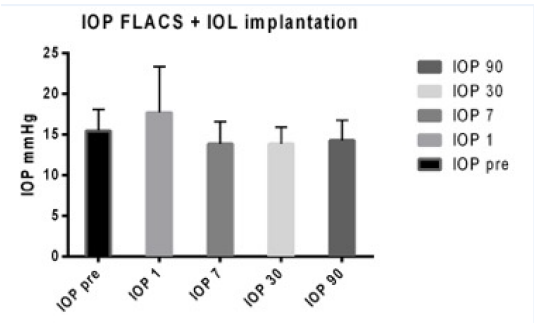

Figure 4. IOP at baseline, 1, 7, 30 and 90 days in the FLACS group.

Patients who underwent FLACS with IOL implantation combined with filtering surgery (n=6) had a baseline IOP of 19.17 mmHg (± 7.7), on post-operative days 1, 7, 30 and 90, mean IOPs were 14.83 mmHg (± 8.06), 11.67 mmHg (± 4.45), 13 mmHg (± 2.5) y 13.17 mmHg (± 1.32) respectively. Although there was a mean lowering of 6 mmHg from the baseline IOP, statistically this difference was not significant, perhaps because of the small sample size (ANOVA p=0.4) (Figure 5).

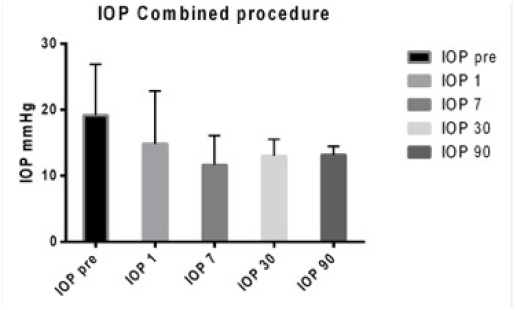

Figure 5. IOP at baseline, 1, 7, 30 and 90 days in the FLACS +filtering surgery group.

Regarding the number of topical hypotensive medications used, patients who underwent FLACS with IOL implantation alone went from 2.30 ± 0.43 to 2.00 ± 0.35 medications with no significant change after surgery (ANOVA p=0.37). Patients who underwent FLACS with IOL implantation combined with a filtering procedure showed a significant change from baseline (3 (± 1.09)), to days 30 (0) and 60 (0.33 (± 0.81)) after surgery (ANOVA p=0.0001) (Figure 6).

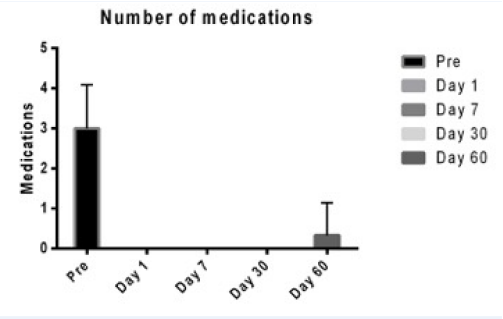

Figure 6. Number of medications at baseline, 1, 7, 30 and 60 days.

Baseline and post-operative MD (-10.72 (± 2.14) and -10.05 (± 2.72) respectively) and PSD (7.09 (± 4.31) and 7.13 (± 4.45) respectively) in VF showed no significant change (p=0.47 y 0.93) (Figure 7).

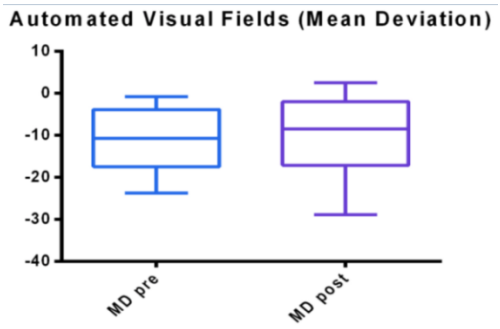

Figure 7. Automated visual fields (Mean Deviation).

Discussion

Cataract surgery is a very common procedure in patients with glaucoma. In our study, we assess IOP changes and surgical outcomes when using the femtosecond laser pretreatment in patients with different types of glaucoma.

In our analysis we found similar surgical outcomes to those published with traditional surgery regarding IOP, BCVA, and VF, with the added advantage of femtosecond laser precision [7].

Suction was well tolerated in glaucomatous eyes, showing no significant IOP raise after docking. BCVA was significantly improved in FLACS alone and FLACS combined procedure. As seen in traditional cataract surgery, patients who underwent FLACS alone did not show a significant IOP decrease, on the other hand, patients who had FLACS with filtering procedure showed a significant IOP decrease that was maintained during follow-up, this group also showed a significant reduction in glaucoma topical medication requirement.

In our study, patients with angle-closure glaucoma were pretreated effectively with no problems regarding their smaller anterior chamber. Also, pretreatment in pseudoexfoliation glaucoma patients did not have added complications, even with the zonular weakness, iris, and anterior capsule changes characteristic in these patients. No complications that have been previously reported in FLACS, like incomplete capsulotomy, tears in anterior capsule or posterior capsule ruptures were recorded during any of these surgeries [8-10].

Conclusion

In general terms, after our experience, we can conclude that FLACS alone or in combination with filtering surgery could be a safe alternative to traditional manual phacoemulsification in glaucoma patients, although further research and a larger sample is needed to increase our knowledge regarding the use of this technology in these patients.

Clinical Significance

The advent of new technology is always an exciting prospect, but with new technology come new possible complications and challenges. Patients with glaucoma must be considered a separate group when thinking about cataract extraction because of the added complexities that a lot of them can present. Although it is widely used, safety and efficacy of FLACS has not been properly studied in the glaucoma population, which could be potentially benefited by the optimization of cataract extraction with the precision of laser technology. In this study we present a sample of patients with different types of glaucoma, who underwent FLACS alone or in combination with filtering surgery and their follow up.

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