



# Comparison of vitreous loss rates between manual phacoemulsification and femtosecond laser–assisted cataract surgery

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**PURPOSE:** To compare the vitreous loss complication rate of manual phacoemulsification cataract surgery with that of femtosecond laser–assisted cataract surgery.

**SETTING:** Mercy Eye Specialists, Springfield, Missouri, USA.

**DESIGN:** Retrospective single-center case series.

**METHODS:** Cataract surgeries from 2010 to 2014 performed by 4 surgeons were audited for rates of vitreous loss. Vitreous loss data were statistically analyzed with and without exclusions.

**RESULTS:** Of the total 7155 cases from 2010 to 2014, 3784 were consecutively performed using manual phacoemulsification from 2010 to 2012 and 3371 were performed using femtosecond laser–assisted cataract surgery from 2013 to 2014. The rate of vitreous loss with exclusions was 1.17% in the manual phacoemulsification group and versus 0.65% femtosecond laser–assisted group; without exclusions, the rate was 1.40% versus 0.77%. In absolute terms, the rate decreased for every surgeon in the study. The chi-square test showed a statistically significant association between the date of surgery, and thus technique, and vitrectomy cases ( $P < .05$ ). Odds ratio analysis with exclusions versus without exclusions indicated that surgeries performed from 2010 to 2012 using manual phacoemulsification were 1.6 times and 1.8 times, respectively, more likely to have vitreous loss than surgeries performed from 2013 to 2014 using the femtosecond laser–assisted cataract surgery technique.

**CONCLUSIONS:** Conversion from manual phacoemulsification to femtosecond laser–assisted cataract surgery resulted in a statistically significant decrease in vitreous loss. Because vitreous loss increases the risk for other serious complications of cataract surgery, this new finding has important implications for the safety of cataract surgery.

**Financial Disclosure:** Proprietary or commercial disclosures are listed after the references.

*J Cataract Refract Surg* 2016; 42:1003–1008 © 2016 ASCRS and ESCRS

Femtosecond laser–assisted cataract surgery is a new method of cataract removal that potentially offers advantages over manual phacoemulsification cataract surgery. It has been shown to improve the reproducibility of incisions, improve the accuracy of the anterior capsulotomy, decrease ultrasound energy use, and decrease cornea endothelial cell loss.<sup>1–6</sup> However, further evidence regarding improved safety is needed. Vitreous loss is a complication that is associated with an increased risk for cystoid macula edema, retinal detachment, hemorrhage, glaucoma, wound complications, and endophthalmitis, which makes it

an excellent indicator to compare the safety of cataract surgery methods.<sup>7,8</sup>

The practice from which this study's data was collected is unique because it represents multiple surgeons at a community-based ambulatory surgery center (ASC) in the United States that made a complete change from manual phacoemulsification to femtosecond laser–assisted cataract surgery. Since March 4, 2013, all cataract surgery has been performed with a femtosecond laser (Catalys, Abbott Medical Optics, Inc.). Two lasers were placed in separate operating rooms, and all patients, with the exception of patients

who could not be positioned under the laser for physical/positional reasons, have had femtosecond laser-assisted cataract surgery since that date. A hard stop-start date was chosen, and it involved all surgeries and all surgeons; therefore, a clear comparison of the vitreous loss rates between manual phacoemulsification and femtosecond laser-assisted cataract surgery could be performed. In addition, this community-based surgery center serves a stable health system population (Mercy Health System, Springfield, Missouri, USA), and patient demographics and comorbidities would also be expected to be similar in the 2 study groups.

## PATIENTS AND METHODS

Operative summaries, self-reporting, and current procedural terminology coding were used to find cases with vitreous loss in the 2 study group timeframes. In addition, all cases that had a vitrectomy set opened were reviewed. This proved to be a reliable method because the vitrectomy set is an inventory item that is scanned into the record by the nursing staff and is independent of surgeon summary or coding.

In both groups, patients received the same preoperative topical drops, including an antibiotic, steroid, and nonsteroidal antiinflammatory drug (NSAID) medication, started 3 days before surgery. Patients continued their routine medications, including anticoagulants. Both groups received the same dilation regimen consisting of 2 drops each of phenylephrine 2.5% and tropicamide 1.0% (Mydracil) 5 minutes apart. Both groups had topical anesthesia only. The manual phacoemulsification group had lidocaine gel, and the femtosecond laser-assisted group had preservative-free tetracaine, 1 drop administered 3 times 5 minutes apart. A peristaltic phacoemulsification system (Infiniti, Alcon Surgical, Inc.) was used in the manual phacoemulsification group and a venturi-based system (Whitestar Signature, Abbott Medical Optics, Inc.) in the femtosecond laser-assisted group.

All surgeries, including the femtosecond laser assisted, were performed in the operating room. In this model, each femtosecond laser is located in an operating room. The patient is prepped and draped, and the laser procedure is performed under sterile conditions. Routinely, the laser portion is performed on the integrated bed first,

after which the bed is rotated away from the laser and placed under the operating microscope. When necessary, such as when placement of a pupil expansion device is required, surgery under the operating microscope was performed before the laser part of the procedure. To improve efficiency, 1 surgeon typically used 2 laser-equipped operating suites.

Each surgeon used the surgical technique of his or her choosing. All surgeons found they had to modify their manual phacoemulsification technique for the femtosecond laser-assisted group. This included using pneumodissection from the gas produced with the femtosecond-treated lens and included, in some cases, the rock-and-roll technique described by Nagy et al.<sup>9</sup> Initially, standard spacing and energy settings of the femtosecond laser were used. Individual surgeons modified the settings going forward.

## RESULTS

The patient demographic data were similar between patients in the manual phacoemulsification group (60.1% women) and patients in the femtosecond laser-assisted group (58.4% women). The mean age of the patients was  $71.0 \pm 9.5$  years and  $71.4 \pm 8.8$  years, respectively.

Table 1 and Figure 1 compare the vitreous loss rates between the manual phacoemulsification group and femtosecond laser-assisted case group. In absolute terms, the rate decreased for every surgeon in the study. Odds ratio analysis with exclusions versus without exclusions indicated that surgeries performed from 2010 to 2012 using manual phacoemulsification were 1.6 times versus 1.8 times more likely to have vitreous loss than surgeries performed from 2013 to 2014 using femtosecond laser-assisted cataract surgery.

The results used for statistical comparison were for only the 4 surgeons who were active during the time period of the study for both manual phacoemulsification and femtosecond laser-assisted cataract surgery (W.J.S., S.T., J.A.G., J.G.O.). A fifth surgeon (R.R.O.) joined the group after completion of residency and performed only femtosecond laser-assisted cataract surgery (Table 2). Those results will be reviewed as part of the discussion and were not used for statistical comparison. The chi-square test showed a statistically significant association between the date of surgery, and thus the technique, and vitrectomy cases with exclusions versus without exclusions ( $P < .05$ ) (Table 2).

## DISCUSSION

To our knowledge, our group is the first in which all of the surgeons, in exact coordination, stopped performing manual phacoemulsification and converted all cataract patients to femtosecond laser-assisted surgery without financial bias or ocular pathology exclusions. We are a community-based practice, and our

Submitted: January 23, 2016.

Final revision submitted: April 13, 2016.

Accepted: April 14, 2016.

From Mercy Eye Specialists (Scott, Tauber, Gessler, Ohly, Owsiak), Springfield, and Mercy Hospital (Eck), St. Louis, Missouri, USA.

Presented at the annual meeting of the ASCRS Symposium on Cataract, IOL and Refractive Surgery, San Diego, California, USA, April 2015.

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