Review of “Comparison of vitreous loss rates between manual phacoemulsification cataract surgery and femtosecond laser-assisted cataract surgery”

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Since the inception of femtosecond laser-assisted cataract surgery (FLACS) in 2009 by Nagy et al., the field of ophthalmology has seen an increase in the proportion of FLACS cases; however, much remains to be investigated regarding the potential risks and benefits of FLACS compared to manual phacoemulsification (MP). The femtosecond laser, initially used to create LASIK flaps circa 2001, was adapted for use in cataract surgery with the hope of providing more accurate corneal wounds, capsulotomies, and keratotomies, and to assist with lens fragmentation, ideally making cataract surgery even safer than it has been since the advancement of phacoemulsification. Potential benefits of FLACS include decreased phacoemulsification energy, more accurate astigmatic keratotomies, less endothelial cell loss, precise corneal incisions and sutureless, perfectly sized capsulotomies. Potential disadvantages of FLACS include a weaker capsulotomy, more expense, increased anterior chamber prostaglandin levels, capsular block, and a steep initial learning curve with higher early complication rates. FLACS also entails increased intraoperative manipulation and time due to the transition of the patient from the laser interface to the operating microscope. Further limitations of FLACS can be encountered as a result of physical patient characteristics (i.e., large body habitus or prominent brow) or ocular pathology (white cataracts, corneal opacification/scarring, small pupils, presence of a bleb or tube, or severe glaucoma). In a large prospective cohort trial, Abell et al. showed similar rates of posterior capsular rupture and dropped nuclei with FLACS and MP, yet FLACS had a statistically significant increased rate of anterior capsular tears compared to MP. A recent comparative cohort study by Ewe et al. did not find a clinically meaningful visual outcome benefit for FLACS over MP. Despite a multitude of studies, no study has proven FLACS to be superior to MP with respect to clinical outcomes, and MP remains a very safe procedure, with greater than 95% of cases having no intraoperative complications.

In the article “Comparison of vitreous loss rates between manual phacoemulsification cataract surgery and femtosecond laser-assisted cataract surgery,” published in the July 2016 issue of the Journal of Cataract & Refractive Surgery, Scott et al. found a statistically significant decrease in vitreous loss rates during cataract surgeries using FLACS compared to MP. This single-center (Mercy Health System, Springfield, Missouri), retrospective case series evaluated a total of 7,155 cataract surgeries performed after this date from March 4, 2013. The only MP cataract surgeries performed after this date resulted from physical limitations that would inhibit positioning of a patient under the laser, docking of the laser on the eye, or complete corneal opacification, which was only a factor in 2% of the cases from 2013–2014. One surgeon was excluded from the study due to that surgeon starting after FLACS had already been implemented, and thus there was no MP data to compare to the FLACS data for that surgeon.

Exclusionary criteria included a preoperative planned vitrectomy, traumatic cataract, combination procedures, and cases requiring iris hooks or iris ring devices. However, the study did analyze the data with and without the exclusionary criteria. The group identified cases of vitreous loss during the study period by reviewing all operative summaries, CPT coding, self-reported incidents of vitreous loss, and vitrectomy set use. The 2 groups were similar with respect to pre- and postoperative drops, aside from the MP receiving lidocaine gel vs. the FLACS group.

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receiving preservative-free tetracaine. All surgeries were done under topical anesthesia. One notable difference between the groups is that the MP group utilized a peristaltic phacoemulsification system, while the FLACS group utilized a venturi system. All of the FLACS cases were done using the same laser platform (Catalys Precision Laser System, Abbott Medical Optics, Abbott Park, Illinois).

Scott et al. reported a combined vitreous loss rate for all surgeons of 1.17% for the MP group versus 0.65% for the FLACS group (p<0.05), with exclusions, and 1.40% for the MP group versus 0.77% for the FLACS group (p<0.05), without exclusions. A statistically significant relationship was shown between date of surgery, and thus technique, and vitreous loss cases using a chi-squared analysis with X2=9.77 (with exclusions) p<0.01. Using odds ratio analyses, the MP cases were 1.6 times more likely to have vitreous loss in the group with exclusions compared to FLACS cases vs. 1.8 times more likely in the group without exclusions.

In analyzing the individual surgeon data, surgeon 1 had the highest number of vitreous loss cases with 35/1,302 cases (2.69%) in the MP group versus 15/907 cases (1.65%) in the FLACS group. Surgeon 2 had 2/289 cases (0.69%) in the MP group versus 1/460 cases (0.22%) in the FLACS group. Surgeon 3 was excluded due to lack of data for MP cases. Surgeon 4 had 3/2,059 cases (0.15%) in the MP group versus 2/1,732 cases (0.12%) in the FLACS group. Surgeon 5 had 4/134 cases (2.99%) in the MP group versus 4/272 cases (1.47%) in the FLACS group. No further statistical analysis was performed regarding individual surgeon data, but the authors note that each surgeon did decrease his or her individual vitreous loss rates during the FLACS period.

This study has several notable strengths. First, this was done in a single-center setting in which all of the surgeons switched over from MP to FLACS on the same day. They reviewed a large number of cases during the MP time period and during the FLACS time period. All surgeons used the same venturi interface and phacoemulsification systems.

Nonetheless, this study does have several significant weaknesses that may preclude establishment of any definitive conclusions from the data. First and foremost, it appears that the group switched from a peristaltic phacoemulsification system to a venturi-based system at the same time that they switched from MP to FLACS. Performance characteristics between surgical platforms are known to vary significantly (e.g., fluid dynamics, phacoemulsification efficiency, etc.). Cahoon et al. demonstrated that a venturi-based system increases the efficiency of lens removal at lower vacuum settings and decreases chatter at the phaco tip. Although this group did not identify an increased risk of capsular tears in a human lens capsule surrogate model when using a peristaltic system, it remains possible that this study’s concurrent change in surgical platform may be a confounding variable that contributed to the reported decreased rate of vitreous loss.

Lastly, it is possible that the results from surgeon 1 played a disproportionate role in overall group vitreous loss analysis. This single surgeon had both a large volume of surgical cases and a substantial reduction in vitreous loss rate, decreasing from 35/1,302 (2.69%) to 15/907 (1.65%) following the switch to FLACS. The group pointed out that this was their most senior surgeon, and thus it is unlikely that this decrease was related to improved surgical skills over time, but rather could be attributed to the FLACS technology. The other 3 surgeons all had either a very low rate of vitreous loss to begin with or low surgical volumes. If surgeon 1’s numbers did in fact “carry the group,” then this report may best be considered an anecdotal example of a single surgeon’s reduced vitreous loss rate following the switch from MP with a peristaltic system to FLACS with a venturi phacoemulsification system, a result that would less likely be generalized or applicable to the typical surgeon.

In conclusion, this study adds to the growing, yet limited, body of literature regarding FLACS and its potential risks and benefits. The debate continues as to whether FLACS offers a true clinical outcome advantage over MP. More research, including large randomized, controlled trials, will be necessary to provide definitive data in this regard. EW

References

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